

THE MEDICAL JOURNAL OF AUSTRALIA

VOL. I.—29TH YEAR.

SYDNEY, SATURDAY, JUNE 20, 1942.

No. 25.

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INFLUENZA VIRUS B: I. OBSERVATIONS ON GROWTH IN CHICK EMBRYOS AND ON THE OCCURRENCE OF ANTIBODIES IN AUSTRALIAN SERUM.¹

By F. M. BURNET,

From the Walter and Eliza Hall Institute of Research in Pathology and Medicine, Melbourne.

LATE in 1940 Francis⁽¹⁾ described a new type of influenza virus (type B), which has no antigenic relationship to any of the standard influenza virus A strains. There is cogent evidence that human infections due to this type were widespread in the United States of America in 1936 and in 1940. The strain "Lee" used by Francis was isolated with great difficulty, and as yet only one other strain of the type has been described (Eaton and Beck⁽²⁾). It appears likely that Magill's⁽³⁾ strain "T.M." is also of the same antigenic type, but no specific statement to that effect has yet reached this institute.

The chief importance of the isolation of this strain is perhaps due to its influence on opinions about the nature of influenza pandemics. There has been a rather tacit assumption that the 1918-1919 pandemic was due to strains of A type, possibly resembling swine influenza virus more than the contemporary human types. With the discovery that a biologically similar but antigenically unrelated virus may cause typical "influenza", the question of antigenic character of the virus strains responsible for past or future pandemics becomes completely open. This problem has been discussed, necessarily in rather specu-

lative fashion, by Burnet and Clark.⁽⁴⁾ Their general conclusion was that the special characteristics of the 1918-1919 pandemic were probably not due, or at least not wholly due, to the appearance of a new antigenic type of virus. A valid solution of the problem cannot of course be reached until a pandemic has been observed with the assistance of modern methods and ideas. In the meantime the part being played by influenza virus types A and B in current respiratory infections needs to be determined as precisely as possible. This paper is concerned with observations on influenza virus B bearing on the past history of this type of infection in Australia and on the practicability of using chick embryo methods for its propagation, should virus vaccines ever be required.

The strain was received from Dr. Francis in the form of dried mouse lung emulsion, and after one passage typical pulmonary lesions were produced in mice. The identity of the virus was checked by showing that it was neutralized by the serum (ferret 77) sent by Dr. Francis and not by our standard "Melbourne", "W.S." and "Swine" immune ferret types of serum.

Characteristics of the Strain.

At this institute influenza virus B is less active in mice than are well-established A strains. With the usual 5% to 10% emulsion of mouse lungs removed three days after infection, fatal infections are invariable with undiluted material; but a 1 in 100 dilution gives only an occasional death, most of the mice showing grade III lesions when examined at seven days. The lung lesions appear to be identical in character with those produced by influenza virus A strains.

No febrile reaction has been produced in three ferrets inoculated intranasally; but subsequent tests showed that antibody had developed.

The virus multiplies readily in chick embryos inoculated by the amniotic route, and we have maintained a passage

¹Work carried out with the aid of grants for research on virus diseases from the National Health and Medical Research Council and from Mr. E. Alec Cato.

series for 100 generations by this method. The lesions produced are indistinguishable from those brought about by type A strains.

Infection of Chick Embryos by the Amniotic Route.

Infection was induced by amniotic inoculation of the original material (dried mouse lung) received from Dr. Francis. The fluid collected from these embryos was, however, contaminated with bacteria, and was filtered through a gradocol membrane before being subinoculated. An amniotic passage strain derived from this filtrate has been maintained, passage being at intervals of two (sometimes three) days.

The lesions produced in the chick embryo show no features to distinguish them from type A infections. In tracheal smears are seen the usual cell types, large vacuolated cells, smaller cells with fragmented nuclei and leucocytes. Sections of the lungs showed lesions identical with those previously described for type A virus lesions.

The virus content of the extra-embryonic fluids (allantoic and, when present, amniotic fluids) tended to be slightly lower than is usual with type A strains, few embryos being infected by fluid diluted to 10^{-4} . Comparative mouse and amniotic titrations are shown in Table I.

There has been no clearly demonstrable change in the character of the strain as a result of the 100 passages. Mouse virulence is unaltered, and no increased capacity to multiply on the chorio-allantois has developed. Its antigenic character has undergone no apparent change; but no attempt has been made to look for minor antigenic differences from the original mouse strain.

The Occurrence of Influenza B Antibody in Human Serum.

Influenza virus B was first isolated in 1940; but retrospective evidence indicates that the 1935 epidemic in California, described by Francis,⁶⁰ was also due to type B strains. In the spring of 1940 there were extensive type B epidemics in the south-eastern States of the United States of America, and a summer epidemic in the West Indies also contained a large type B component (Lenette *et alii*⁶¹). Lush *et alii*⁶² found that a number of cases occurred in the 1939 English epidemic, though none were recognized in the winter of 1940-1941.

For a number of years we have taken and preserved annual samples of serum from members of the laboratory staff. A survey of these specimens, as well as of recent samples from other groups of subjects, provides a considerable amount of evidence as to the past prevalence of influenza virus type B infections in Victoria.

Technique.—Most of the tests on human serum were made by means of a simplified technique. Standard virus suspension was made by grinding two half lungs from mice infected three days previously with five cubic centimetres of broth and centrifuging. Equal volumes of undiluted virus and undiluted serum were mixed and three mice were inoculated intranasally with each

mixture. Lung lesions were recorded at death or after seven days. By means of this method specimens of human serum could be divided conveniently into three groups: those with high level of antibody (causing no lesions or at most grade I areas in the inoculated mice), those with low level of antibody (at least one mouse of the three dying with specific consolidation), and those with intermediate amounts.

Seven specimens of serum obtained in 1935 or 1936 were available for test. Two of these contained a high titre of antibody; the other five had little or no antibody. Neither of the two subjects with antibody can remember any definite influenzal illness in the years immediately preceding 1935 and 1936.

One of the subjects with little or no antibody in 1935 or 1936 subsequently developed antibody against influenza virus B. Table II gives the results of a comparative titration of yearly serum samples from this subject.

Table III collects the results of titrating serum samples taken over 1939 to 1941 from 55 unselected adults.

TABLE II.
Tests of Successive Serum Samples from D.P. against a Standard Dose of Type B Virus.

Date.	Mouse Lung Lesions.	Remarks.
March, 1936	3 3 3	
June, 1937	4 ⁺ 3 3	
March, 1938	4 ⁺ 3 3	
July, 1939	1 1 0	Febrile illness November, 1938.

These results allow certain provisional statements to be made about the recent distribution of influenza virus B infections in Melbourne. Definite evidence of its presence between June, 1938, and July, 1939 (probably in November, 1938) has been obtained from serum titrations. About 30% of a random collection of serum samples taken during the period from 1939 to 1941 contain antibody of titre equal to or above that of the post-infection serum samples from the subject known to have been infected. It is a

TABLE III.
Distribution of Type B Antibody in Samples of Human Serum taken during the Period from 1939 to 1941.

Antibody Titre.	Mouse Lesions.	Number of Persons.	Percentage.
High	0-1	13	29
Medium	1-3	9	20
Low or nil	3-4	23	51

reasonable inference that this represents about the proportion of subjects who have been infected during the last five or six years. The remaining 70% have lower antibody levels; but we have not yet tested serum from an adult human being which had no trace of neutralizing

TABLE I.
Titrations by Amniotic and Mouse Lung Methods of Extra-embryonic Fluids from Embryos Infected with Influenza Virus B.

Passage.	Method.	Titration.						
		10^{-1}	10^{-2}	10^{-3}	10^{-4}	10^{-5}	10^{-6}	10^{-7}
2nd ..	A. M.*	4 ⁺ 4 ⁺ 4 ⁺	4 ⁺ 3+ 3	3 3 2		+ + +	+ + (+)	+ -
20th ..	A. M.	4 ⁺ 4 ⁺ 4 ⁺	3 2 x	2 2 2	+ + + 1 0 x	+ + (-)	- - -	- - -
57th ..	A. M.	4 ⁺ 4 ⁺ 4 ⁺	4 ⁺ 4 ⁺ 3	2 2 1	+ + + 1 1 1	+ +	+ (+)	+ - -

* The conventional symbols for the intensity of mouse lung lesions (M.) are used.

† Amniotic results (A.) are indicated as follows: +, typical lesions and tracheal smear; (+), death presumably from specific infection; —, embryo normal four days after inoculation; (—), embryo apparently normal two to three days after inoculation.

activity. This suggests rather strongly that there have been prevalences of B type infection in Australia during the years prior to 1935. The only extensive epidemics of influenza since the beginning of 1935 in Melbourne were those of July, 1935, and July, 1939. A type A strain was isolated from the only subject studied in 1935, and it is conceivable that this epidemic included type B infections. The 1939 epidemic was more carefully studied; several type A strains were isolated, and all the patients studied serologically gave evidence of type A infection. It was apparently a homogeneous type A epidemic. The general impression one receives is in agreement with the view expressed by Taylor (personal communication) as a result of experience in Argentina, that type B infections in Victoria have been largely sporadic in character and not associated with definite epidemic prevalences.

The Hirst Phenomenon with Type B Virus.

Hirst's⁽¹⁰⁾ method of titrating allantoic fluid influenza virus by agglutination of fowl red cells is equally applicable to type B virus, and since the appearance of Hirst's work we have used the method extensively at this institute. As an example of the results obtained. Table IV shows a titration of some of the same serial samples of blood taken from D.P. as were shown in Table II.

TABLE IV.

Demonstration of Time of Type B Infection by Red Blood Corpuscle Agglutination Method.

Serum.	Date.	Serum Dilutions.*					
		10	20	40	80	160	320
D.P.	March, 1936	—	tr†	+++†	+++†	+++†	+++†
	March, 1938	—	+	++	++	++	++
	May, 1939	—	—	—	—	—	—
	July, 1939	—	—	—	—	—	—

* Stock virus B serum diluted 1:10 to each tube.

† "+++", "++", "+", "tr" represent diminishing degree of agglutination of fowl erythrocytes under standard conditions.

Another application of Hirst's method has been to simplify greatly the technique of titrating the virus content of, for example, infected allantoic fluids. Instead of the rather complicated amniotic method of inoculation, the successive dilutions can be introduced with a syringe and needle into the allantoic cavity, a dose of 0.05 cubic centimetre being used to make results comparable with those of other methods. After three days' incubation at 35° C. the eggs are opened and some of the allantoic fluid is tested for its power to agglutinate fowl red cells. The following is a typical result with a stock type B allantoic fluid: virus dilution 10⁻⁶, +, +, +; 10⁻⁷, +, +, -; 10⁻⁸, +, -, -; 10⁻⁹, -, -, -. The results of such tests are strikingly definite, the agglutination being either complete to a dilution of at least 100 or wholly lacking.

Summary.

1. Influenza virus B (Francis strain) can be grown in chick embryos inoculated either by amniotic or by sub-allantoic methods. The lesions produced are entirely similar to those of influenza virus A.

2. Tests with human serum taken in Australia indicate that influenza virus B infections have occurred in recent years. In the case of one subject, retrospective study of serum samples indicates that an attack of type B influenza was experienced in November, 1938.

3. Hirst's method of virus and antiserum titrations is applicable to influenza virus B, and two applications of the method are described.

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INFLUENZA VIRUS B: II. IMMUNIZATION OF HUMAN VOLUNTEERS WITH LIVING ATTENUATED VIRUS.¹

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In the course of work as yet unreported on the immunization of human subjects with partially attenuated strains of influenza virus A, it was observed that responses in the form of an antibody rise were almost wholly limited to those subjects with low initial antibody titre. In the student population from which the subjects were drawn low titres against A strains were rare, but a fair proportion showed very little type B antibody. Immunization of an unselected population against type B virus would therefore be expected to provide a correspondingly greater proportion of significant responses. Since any form of immunization against clinical influenza will require that protection be afforded against type B as well as against type A strains, experiments have been made to determine the practicability of immunization with living type B virus given intranasally. These experiments have revealed a uniform immunological response in persons having antibody below a certain level and offer presumptive evidence that an increased resistance to influenza virus B is induced in such subjects.

The procedure was essentially similar to that used in earlier work (Burnet and Foley⁽¹⁾). Volunteer subjects were inoculated with suitably prepared virus sprayed into the nose and to the back of the throat with an atomizer. A blood sample was taken immediately and again three weeks later; any symptoms were noted, and the two serum samples were compared for change in antibody content.

Material and Technique.

The virus used was derived from the mouse passage strain "Lee" kindly sent to this institute by Dr. Francis. In view of the difficulty in adapting the strain by ferret and mouse passage, it is probable that its virulence for man had fallen greatly during this process; but it was thought advisable to give the strain 40 amniotic passages in chick embryos before its action in volunteers was tested. Material for immunization was prepared by the inoculation of thirty-ninth passage seed virus (stored in a solid carbon dioxide refrigerator) into twelve-day eggs by the suballantoic method (Burnet⁽²⁾). The allantoic fluid was collected after forty-eight hours' incubation at 35° C. The following improved method of harvesting the fluid has not previously been described.

¹ Work carried out with the aid of grants for research on virus diseases from the National Health and Medical Research Council and from Mr. E. Alec Cato.

The eggs are removed from the incubator and placed for two to four hours in a refrigerator. This chilling practically stops the circulation and makes it easy to remove the fluid uncontaminated with blood. The difficulty of doing this from unchilled eggs is commented on by Hirst.¹⁰

A groove in the shell is cut with a dental drill around the margin of the air space at the blunt end of the egg. The egg is supported vertically and the cap of shell is removed with the outer layer of the shell membrane. The exposed circular area of deep layer shell membrane and chorio-allantois is cut around with scissors and reflected over one edge of the shell. The allantoic fluid can now be readily removed with a Pasteur pipette; as a rule about eight to ten cubic centimetres of slightly turbid fluid are obtained from each egg.

The fluid was tested for sterility by plating a loopful on blood agar, and for virus content by Hirst's method. As a rule each batch of virus was also titrated by one or other of the *in vivo* methods, usually by amniotic inoculation of twelve-day chick embryos. The pooled fluid used in the present experiments produced partial agglutination of fowl erythrocytes in a final dilution of 1,000 to 2,000 and infected a majority of chick embryos injected with 0.05 cubic centimetre of a 10^{-7} dilution.

The virus was administered by means of a de Vilbiss atomizer with nasal nozzle. Two firm pressures of the bulb were given with the nozzle in each nostril and a further single spray to the back of the throat. About 0.2 cubic centimetre of undiluted allantoic fluid was used for each subject.

Serum titrations were made by mouse intranasal inoculation, the conventional methods being used, and by the modified Hirst technique recently described (Burnet¹¹). The results are expressed in terms of a serum F159 from a ferret infected with type B virus.

Results.

No serious symptoms followed the inoculation in any of the subjects. Of those who on subsequent testing showed a rise in serum antibody level and therefore were presumably infected by the virus, six showed no symptoms, two noticed some increase in nasal secretion and stuffiness in the nose two days after inoculation, while one observed no nasal symptoms, but had an outbreak of labial herpes five days after the inoculation. Normally his herpetic attacks are induced by colds. A child, aged ten years, given mixed virus, but reacting only to the B component, showed a sharp onset of coryza with sneezing forty-eight hours after the administration. Serous discharge and obstruction of the airway persisted for two days, but there were no toxic symptoms whatever and no development of any mucopurulent discharge. One subject showing a slight rise of antibody level by mouse test, but none by Hirst's method, had a severe headache two days after inoculation, but no elevation of temperature and no catarrhal symptoms. This strain therefore appears to be capable of producing only trivial symptoms, and in a majority of those showing an active antibody response caused no recognizable symptoms at all.

Hirst test results are shown graphically in Figure 1.

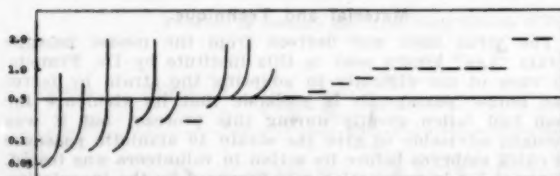


FIGURE 1.

Results of Hirst tests made with samples of serum before and three weeks after intranasal administration of amniotic passage type B influenza virus to a group of 22 volunteers. Arranged in order of initial antibody level.

Samples of serum from subjects showing a rise in antibody level by Hirst's method were tested by mouse inoculation, and in all instances the rise was confirmed. Table I shows the comparative results obtained with a

selection of "positive" and "negative" examples from Figure 1. It will be noticed that the rise in titre shown by mouse tests is in each instance considerably greater than that shown by Hirst tests. The difference appears to be mainly related to the fact that the initial titre of subjects who react appears to be much lower by mouse test. The higher value given by Hirst's method is probably the result of non-specific or group-specific inhibition of agglutination with the higher concentration of serum.

TABLE I.

Comparison of Hirst and Mouse Lung Tests for Influenza B Antibody in Human Serum taken Before and After Experimental Administration of Influenza Virus B.

Subject.	Hirst Test.	Mouse Test.
H.	0.05-0.5	10 x
Z.	0.05-0.3	5 x
Cr.	0.06-1.0	16 x
Co.	0.2-1.0	5 x
Ba.	0.25-1.0	4 x
Bu.	0.5-0.5	1 x
Na.	0.5-0.5	1 x
		0.0005-0.2
		0.005-0.1
		0.01-2.0
		0.02-3.0
		0.005-0.2
		0.1-0.1
		0.02-0.02
		400 x
		20 x
		200 x
		150 x
		40 x
		1 x
		1 x

The first result column in each test shows the values obtained for first and second samples of serum expressed in terms of the activity of a ferret immune serum F159 which was taken as a standard. The second result column indicates the increase in terms of the initial antibody concentration for each subject.

Discussion.

The results obtained in this experiment represent the most promising indication we have yet obtained that effective immunity to one type of influenza may be produced by the administration of attenuated virus. The only valid test for immunity is, of course, exposure to a naturally occurring epidemic of the corresponding type of virus. Nevertheless, in a sense the administration of the immunizing spray represents a test of immunity as well as an immunizing procedure. It is difficult to avoid the deduction from Figure 1 that antibody level is a fairly accurate index of susceptibility to experimental infection with the attenuated strain, and that by such experimental infection the antibody level is raised above the susceptible level. Provided that natural and experimental susceptibility are governed by the same factors, the results suggest strongly that by this means the relatively small proportion of people who at any one time are highly susceptible to influenza could be brought into the larger group of normally resistant people, who do not contract influenza. Further work along these lines with mixtures of attenuated type A and type B influenza virus is being carried out.

Summary.

Living influenza virus B adapted to chick embryo passage has been administered intranasally to volunteer subjects. Those subjects with initially low antibody level as judged by Hirst's method responded with a significant increase in antibody level. Only trivial symptoms or none at all were observed. It is possible that this technique may provide a useful method of immunization against influenza virus B.

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ELECTRICAL CONVULSIVE THERAPY.

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IN 1938 Cerletti and Bini demonstrated that a strong alternating electric current passing through the head produced instantaneous unconsciousness, followed by an epileptiform seizure. Fleming, Golla and Grey Walter and others carried the research further, and at the present time two or three manufacturers in England are providing apparatus for use when convulsive therapy is indicated.

According to the early workers, convulsive therapy by electrical means had many advantages over the intravenous injection of such drugs as "Cardiazol". However, inquiries some twelve months ago showed that no apparatus could be obtained in Australia, yet, from the rather meagre technical information given in the various journals, the construction seemed to offer no insuperable difficulty.

Accordingly, an attempt was made to construct this apparatus, which, when completed, was submitted to Professor Kerr Grant, of the physics department of the University of Adelaide. The construction from the viewpoint of physics, and as an electrical mechanism, was passed by Professor Kerr Grant, to whom I am greatly indebted for the valuable assistance given.

The apparatus, after going through the experimental stage with rabbits as subjects, has now been in use at Parkside Mental Hospital during the past nine months for the production of convulsive seizures in patients suffering from severe forms of mental disorder. It is confessed at once that the preliminary use on patients was accompanied by much apprehension—not, as with "Cardiazol", on the part of the patient, but on the part of the operator. Had I been in need of shock therapy for schizophrenic or manic-depressive illness, I feel quite certain that the psychogenic "shock" to me would have been all that was necessary.

Physics.

The electroencephalogram is a recording of the differences in brain potential, which varies like the electrocardiogram and can be used similarly for diagnostic purposes. Moreover, direct stimulation of the appropriate exposed cortex by strong faradic currents produces movements of certain muscles, and it was this method of experimental work which confirmed the teachings of Hughlings Jackson of many years before. Jackson's deductions, from clinical observation of what he called the experiment made on the brain by disease, were revolutionary and remarkable for their accuracy. But it was Cerletti and Bini who had the courage to apply the extremely strong alternating currents to the sides of the head to stimulate the underlying brain cells. In their method voltages of 100 to 150 were necessary because of the strong resistance offered by the scalp, bone and other tissues. While 10 milliamperes applied to exposed cortex will produce muscular movement, the current necessary to produce the convulsive state is somewhere between 300 and 1,000 milliamperes.

Clinical comparison of the spontaneous differences in potential of the exposed cortex and the overlying intact skin, as in the leads for electroencephalography, showed that there was an attenuation by one hundredfold, so that the current applied in the reverse direction would be dissipated and similarly reduced when it actually reached the cortex.

In our series of cases I believe the current passing transtemporally varied from 500 to 1,000 milliamperes. Actually the machine was at first provided with a fuse which "blew" at approximately 500 milliamperes when the current's duration was 0.2 second. With a number of patients the fuse did give out, so that it became necessary to increase its capacity. It may be possible at a later date to incorporate an instrument that will

accurately record the current passing through the head; but up to now it has been impossible to procure such an instrument.

Description of the Apparatus.

The information given in the various journals on the construction of the electric convulsive apparatus was incomplete in detail, but the chief difficulty seemed to be the timing mechanism, which was to permit the current to flow for one or more tenths of a second. However, this problem was overcome; but there arose many other difficulties which at first seemed insurmountable.

In short, a voltage varying from 60 to 150 had to be applied to the temporal regions for a time period varying from one-tenth to five-tenths of a second, and in each instance the time period had to be accurate.

A transformer was made by a reputable firm to give the various voltages and the current was then led to a selector switch. This transformer was specially constructed so that there could be no possibility of a short-circuit between the primary and secondary windings, and, on the face of the apparatus, the red light (R.L.) showed when the power was on.

For the time switch, an automatic telephone dial mechanism was made available by the Postmaster-General's Department. Segments of brass of varying circumference were then cut, and by means of two bosses they were fitted into the telephone dial mechanism (A.T.D.). These bosses fitted accurately into the 7 and 9 of the dial, while the circumference overlapped the circle of the dial so that the edge of the segment would brush against the spring contact (S.C.) as it made the circular movement.

Subsequent testing showed that the time of contact could be most accurately determined by this method. The dial and the spring contact were in a low tension circuit consisting of a battery, two separate relays and a hold-down switch (L.T.H.S.); with the main switch (S.W.1) off, the dial was pulled from 0 to the starting point and the segment was placed in position. The power was then switched on and the hold-down switch depressed and release of the dial allowed the segment to complete the circuit for the desired time period, thereby closing the two pairs of points of the relays in the high tension circuit.

Two relays were used to avoid the remote possibility that one might stick and so give a shock of dangerous duration. Every conceivable precaution had to be incorporated, so a fuse and a second hold-down switch (H.T.H.S.) were placed in the high tension circuit.

Thus to administer the shock four things had to be done: the switch (S.W.1) had to be on, the segment had to make contact with the spring contact, and the two hold-down switches had to be held down by two fingers, which could be instantly removed should any fault occur. The current to the patient could not inadvertently be left on. This part of the mechanism caused no difficulty, whereas it needed a great deal of work to complete the third circuit for measuring the resistance offered by the head.

The Measurement of Head Resistance.

The measuring current had to be alternating, as the results of direct current were misleading. A separate transformer with an output of 0.75 volt was therefore necessary. Alternating currents over one milliampere were uncomfortable to the patient, and as it is extremely important that no pain shall be experienced by the patient during the measurement, lower currents had to be used. Now the alternating current must be rectified before it passes through the galvanometer (G.) and this takes some of the current. I understand that more delicate measuring instruments are made, but at the time none were available. The galvanometer was then calibrated to read in ohms in the alternating measuring circuit, and it is worth noting that living tissues do not obey Ohm's law.

In this circuit are placed a switch and green light in the primary, and the galvanometer with metal rectifier and fuse in the secondary.

One description of the measuring circuit had incorporated a Wheatstone bridge, and while this method of determining the resistance of the head gave accurate readings when direct current was used, I found that it was impracticable with the small alternating currents. To be of any use at all, the ohmic resistance to alternating currents is necessary.

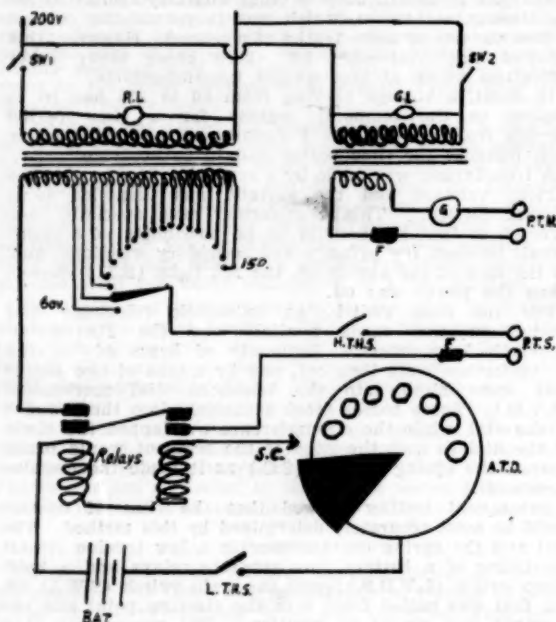


FIGURE 1.

SW1: 200 or 240 volt switch, main transformer; S.W.2: 200 or 240 volt switch, 2 volt transformer; R.L.: red light; G.L.: green light; L.T.H.S.: low tension hold switch; H.T.H.S.: high tension hold switch; S.C.: spring contact; A.T.D.: automatic telephone dial; P.T.M.: patient's terminals (measuring); P.T.S.: patient's terminals (shock); F.: fuse.

Preparation of the Patient.

The patient is prepared as for "Cardiazol" treatment, breakfast being omitted and the bowels and bladder emptied if he is cooperative.

The temporal regions are cleansed with ethereal soap and then swabbed with spirit containing 10% of sodium chloride. Two thicknesses of lint are then soaked in 20% saline solution and placed between the electrodes and the skin, which has previously been shaved or at least closely cropped.

The metal electrodes, about two inches in diameter, are held tightly in contact with the patient's head by a strong rubber band. These electrodes are then connected to the patient's terminals (P.T.M.) of the measuring circuit. The current is then switched on and the deviation of the galvanometer is noted; in the series of cases at Parkside this showed that the head resistance varied between 350 and 1,000 ohms. The individual resistance measurements of different patients bore no direct relation to the current necessary to produce the seizure. Actually some patients with low resistances needed high voltages to produce the convulsive state. The value of these measurements is to ensure good contact of the electrodes and for comparison with previous readings from the same patient. The voltage and duration can then be decided upon. The above procedure having been followed, the plug connecting the wires from the patient to the apparatus is then changed over from P.T.M. to P.T.S., and although this could be more easily effected by a switch, it was deemed advisable as an extra precaution to adopt the former method.

The position of the electrodes is important. The centre of each electrode should be in front of the coronal suture, and the lower edge about half an inch below the orbito-

meatal line. The preparation of the skin area should be thorough and the lint pads uniformly wet so that a few drops of the saline solution are expressed when the rubber band is applied.

The Administration of the Shock.

The patient is in bed, undressed, and the assistant stands by with tongue depressor and with his hand resting on the rubber band at the centre of the patient's forehead. This is to prevent the acute flexion of the body which has, in some cases during "Cardiazol" treatment, resulted in vertebral fractures.

Different workers have advised commencing with varying voltages and varying time periods; but at Parkside we now start with 75 volts and keep the duration of the current to 0.2 second. With this current we have produced no seizures; the result appears to be a momentary unconsciousness, and a simultaneous start, in which the patient raises his head from the pillow.

The instantaneous "start" probably involves all the skeletal muscles and is no doubt due to the direct stimulation of the precentral gyrus.

Were it not for the coincident unconsciousness, the patient would, in cases in which the dose was sub-convulsive, experience an unpleasant stimulation of the temporal regions. Immediately after the abortive seizure, pallor of the face and depressed respiration are noted. The duration of the unconsciousness is usually brief, and this is followed by a varying period of confusion and in some cases by restlessness for a minute or two.

No pain or unpleasantness is experienced, and the behaviour of patients, who had previously been most resistive to "Cardiazol", quietly submitting to repetitions of electrical treatment, is most remarkable. This absence of apprehension—nay, acute terror in some cases—is, in my opinion, one of the several advantages of electrical convulsive treatment.

When one has failed to produce the seizure, the electrodes are reapplied after a few minutes and 80 or 85 volts are given. It has been advocated by some that the initial dose should be 130 volts, while others recommend starting with lower voltage and giving as many as six shocks in succession, each at a higher voltage, until the seizure is produced. At Parkside we prefer to give not more than two or three shocks at one treatment and start with a higher voltage three days later if the desired result has not been achieved on the former occasion. However, the threshold dose is soon found and generally speaking remains about the same for subsequent occasions, although in some cases the voltage must be increased.

The threshold dose thus having been determined for each patient, subsequent variations of voltage are then dependent upon the varying differences in resistance as shown by the galvanometer.

The Seizure.

In general, the seizure is similar to that produced by "Cardiazol", but each patient shows individual variation. If the voltage and duration are correct, then the convulsions commence instantaneously with the passage of the electric current, often with a cry; but even when the onset of the convulsion has been a little delayed I have not noticed the preliminary cough that so often occurs with "Cardiazol". In one case there was on two occasions a delay of twenty to twenty-five seconds before the fit commenced, but in this case the dosage was not high enough.

If the current is insufficient, there is often a small stifled cry, followed by a slight pallor and muscular restlessness, and then some flaccidity. In these cases there is momentary unconsciousness with retrograde amnesia for ten minutes or more immediately preceding the current application. This amnesic period is well defined, as the following case will show:

A young woman, typically but mildly schizophrenic, had her course of seizures interrupted while I was on leave for two weeks. The patient's condition had improved considerably, and for ten minutes prior to the recommencement of her treatment she conversed with me and accurately recounted the interval since I last saw her, mentioning days, dates and the fact that I had been on leave. An

abortive seizure followed the application of the current, and within three minutes she was apparently her normal self. She then conversed about the fortnight's interval with the same degree of accuracy, and was completely oblivious of the fact that she had discussed this subject a few minutes previously.

There is in all cases no memory of the shock, and no pain whatsoever is experienced.

The major seizure occurs as follows. The patient becomes immediately unconscious and gives the simultaneous "start", which is quickly followed by the general muscular spasm; in this the thighs are flexed and the legs raised off the bed. The arms are held flexed in front of the body with the usual carpal spasm as seen with "Cardiazol" treatment. The tendency for the trunk to be acutely and strongly flexed is less with the electroconvulsive method.

The eyes show strong conjugate deviation in an upward direction, either to left or to right. The mouth is open for a brief interval, but soon clamps on the gag. The tonic spasm varies from three to twelve seconds and generally is shorter than that of the "Cardiazol" seizure.

The clonic stage then follows, and as the movements are becoming of greater amplitude and dying down, the colour of the patient is frequently ghastly and alarming in the degree of lividness. Often one is on the point of commencing artificial respiration with oxygen when the patient takes a breath; this is followed by an interval of a few seconds before the second breath is taken. After this the colour rapidly returns to normal. Some patients have pronounced salivation and free skin action after the seizure. The patient then often sleeps for four to ten minutes and the time taken for the return to consciousness varies up to thirty minutes. Generally the patient is able to take some food shortly afterwards and to walk back to the ward within the hour.

One patient showed some restlessness after his seizure for about two minutes, rolling over in the bed and drawing up his legs.

In no case was urine or faeces passed.

The duration of the seizures is usually about forty-five seconds, but I have known many lasting from sixty to seventy seconds.

Abortive Seizures.

In the early phase of this work at Parkside the voltages had to be low and progress was slow, as the dose was stepped up by five volts each time until the seizure dose was reached. We did not at first dare to give more than one application at a time; later on we began with higher voltages and gave three applications within a few minutes if we did not achieve the desired results in the first instance. It was found later that many of the seizures were abortive because of the big fluctuation of voltage in the electricity company's lines. This variation of voltage was due mainly to the fact that the operating theatre was adjacent to a large laundry with multiple motors either in action or starting and stopping. The company has promised to rectify this; but in the meantime it is found that during the lunch-hour of the laundry we are able to judge the dose with fairly reasonable accuracy.

There was no indication that the abortive seizure caused any apprehension for further treatment. After one such seizure, the patient remarked that she had been asleep; she was unable to estimate how long, but thought she had been dreaming.

The blood pressure underwent little change, and pulse rate returned to normal in a few minutes, after having increased by ten to twenty beats per minute.

Results of Treatment.

This article was written primarily as the description of the constructional details of the apparatus, and although this form of therapy has now been in use since August, 1941, the number of patients treated is relatively small. It will be appreciated that extreme caution was necessary, especially as the apparatus was constructed by myself, a mere amateur, and not by any electro-medical company.

At first, patients were selected for whom the prognosis was practically hopeless and who had resisted all other

forms of treatment. Later, we treated patients who had a better prognosis, but who nevertheless had had a considerable amount of treatment before reaching the mental hospital. Progress, therefore, was somewhat slow.

In psychological medicine especially we have all seen the advent and passing of new forms of treatment, and it may be that electroconvulsive therapy will suffer a similar fate. Certainly we are treating desperate illnesses, but equally certainly, whether it be by "Cardiazol", insulin or the electrical method, we are by these methods causing a colossal upheaval in the organism.

The brain is the most delicate structure of the body, and one sometimes wonders whether, in applying these strong measures, we may not do some irreparable damage. Up to now I have seen no ill effects from electrical convulsive therapy, and Golla is most certain that no harm can be done with the specified voltages and times; but I most earnestly hope that this form of treatment will not be used without the utmost discrimination.

"Cardiazol" and insulin are both valuable in proper hands and when coupled with psychotherapy, and yet both these forms of treatment have suffered because of misuse. It is also necessary to stress the fact that electroconvulsive therapy is not a panacea for all mental ills. Probably all superintendents of mental hospitals will recall the numerous requests he has received to give "Cardiazol" and insulin in cases of gross mental deficiency and even dementia. In these cases, false hopes had been given to the relatives by their reading in the lay Press quite astounding and inaccurate reports of the virtues of these later forms of treatment.

At this stage of our work it can be said that electroconvulsive therapy is a valuable additional method in the treatment of manic-depressive psychosis and schizophrenia. Compared with such drugs as "Cardiazol", I think it has distinct advantages. It must be borne in mind that in present circumstances Australia may be cut off from the supply of anaesthetics, and as the manufacture of this apparatus presents no difficulty, there should be no need to discontinue shock therapy.

The method of application, while needing every care, is relatively simple, and where it is necessary to treat a number of patients at the one time, this can be done with the minimum of time.

The cost of treatment is negligible apart from the initial outlay, and I would mention that, when convulsive treatment is advisable and one finds unsuitable veins or veins previously thrombosed, the electric method offers no difficulties.

As has been stated previously, the prognosis for all patients in the first series was particularly bad, and after treatment there was no appreciable improvement. The next series also had had a considerable amount of treatment before reaching the hospital, and quite a number of these manifested outstanding improvement, despite the fact that, with one exception, the duration of their mental illness was well over one year.

With regard to the merits of this form of treatment as viewed from the standpoint of complete recovery. I prefer to wait until time and further experience allow definite facts to be presented.

Acknowledgements.

In the actual construction of the apparatus, I am indebted to a number of friends who assisted in solving the numerous difficulties that frequently occurred. In this respect, I desire to acknowledge the continuous technical advice and experimental work given by Mr. A. E. Barbier.

Dr. F. J. Ryan's assistance in the clinical treatment of all patients was specially valuable by virtue of his long experience in "Cardiazol" and insulin therapy.

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AN ABBREVIATED WASSERMANN TEST.

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In a private laboratory, where the specimens arriving for the Wassermann test rarely amount to more than a dozen a week, and where the reports are often asked for within twenty-four hours, it is not satisfactory to set apart only one day a week for carrying out the test. The Kline and other precipitation tests are certainly available for immediate reports; but medical men prefer the complement fixation test, and expect it to be done. If, therefore, one wishes to carry out the test two or three times a week, maybe twice in one day for urgent reports, the usual methods, such as the Medical Research Council's method, the Kolmer method or any of their offspring, all of which are lengthy procedures, do not recommend themselves. And so, after thirty years' practice with the test, the writer has evolved the method here described. It is based on Wassermann's technique as taught by him in 1909, with the interpolation of a stage in the refrigerator. The test can be carried out at an hour's notice; a report can be given within two hours after the arrival of the specimen.

The writer has performed the test several times a week for several years. All results were compared with those of the Kline test; the positive control serum was obtained each week from other laboratories, from public hospitals or from government institutions, in order to make comparison with other well-established methods.

The Preparations.

Complement.—The serum of any healthy guinea-pig is used. Sex is of no consequence, no special feeding is required, and no pooling of serum is necessary. The dilution is 1 in 10. If the serum is kept in the refrigerator, it remains serviceable for several days.

Sheep Cells.—Sheep cells are washed and packed solid. A dilution of 1 in 20 is used. The material is kept in the refrigerator and is serviceable while the superimposed fluid is only faintly coloured red.

Amboceptor.—Sheep cell-immune rabbit serum is the amboceptor employed. A high titre is not essential. The dose is determined for each test by testing of the hemolytic system. The Commonwealth Serum Laboratories' hemolysin serves very well.

Titration of the Amboceptor and Testing of the Hemolytic System.—Titration of the amboceptor and testing of the hemolytic system depend not so much on the quality of the reagents as on their interaction.

Dilution and Distribution of the Amboceptor.—Make up a 1 in 100 dilution, 0.05 cubic centimetre of amboceptor and 4.95 cubic centimetres of saline solution. Arrange six test tubes in a row; into each place 0.5 cubic centimetre of saline solution; into the first place 0.5 cubic centimetre of the 1 in 100 amboceptor, mix, and into the second tube place 0.5 cubic centimetre of the mixture. Mix, and into the third tube place 0.5 cubic centimetre of the mixture. Continue thus to the last tube, and from it discard 0.5 cubic centimetre. The successive tubes will then contain 0.5 cubic centimetre of increasing dilutions: 200, 400, 800, 1,600, 3,200 and 6,400. To each tube add 0.5 cubic centimetre of the 1 in 10 complement dilution, and mix. To each tube add 0.5 cubic centimetre of the 1 in 20 cell dilution, and mix. To each tube add 1.0 cubic centimetre of saline solution, and mix. Each tube thus contains 2.5 cubic centimetres, representing 0.5 cubic centimetre of each of the five reagents used in the main test.

Place the tubes in the water bath at 37° C. for ten minutes. Shake occasionally. Then inspect the tubes and determine the last tube in which complete hemolysis has occurred. This is best done by standing in front of a window, and focusing a bar of the window through the fluid. Complete hemolysis is indicated by the completely clear appearance of the bar. The dilution in the tube thus selected is the one to be used in the main test.

The Main Test.

The patient's serum is inactivated in a water bath at 55° C. for thirty minutes; the dilution is one in five. The preparation of the antigen will be described later. Every antigen prepared has its titre worked out. The method of titration will be described later. The titre, once determined, remains constant to the last drop. Only one antigen is used at a time.

The main test requires for controls a previously proved "positive" and "negative" serum. Further controls are a double dose of the serum, without antigen, and a double dose of the antigen, without serum. Prepare the tubes as follows. For each specimen of serum in the test there is a double row of tubes. At the end of the front row there is an additional tube for the antigen control.

Dilution and Distribution of the Serum.—Into each tube of the back row place 1.2 cubic centimetres of saline solution; to it add 0.3 cubic centimetre of the relevant specimen of serum, and mix. Out of this tube take 0.5 cubic centimetre, and place in the front row. There are, then, for each specimen of serum a single dose in the front row and a double dose in the back row.

Dilution and Distribution of the Antigen.—The dose of the antigen was determined when it was made; that dose is constant. Let us consider that the antigen used in this test requires a dose of 0.1 cubic centimetre. Suppose there are eight specimens of serum in the test, including the control specimens. The number of serum tubes is eight in a front and eight in a back row. The specimens have been distributed. The front row contains a single dose, the back row a double dose; only the front row receives antigen.

For the eight specimens one requires 8×0.1 cubic centimetre; adding a double dose as a control, one requires 10×0.1 cubic centimetre—one cubic centimetre of the antigen. Place this into an additional tube in the front row. To bring each dose up to a bulk of 0.5 cubic centimetre, one must add 0.4 cubic centimetre of saline solution. For ten doses one requires four cubic centimetres. The calculation is made as follows: there are $10 \times 0.1 = 1.0$ cubic centimetre of antigen; $5.0 - 1.0 = 4.0$ cubic centimetres of saline solution. This amount of saline solution must be added to the antigen very gradually, and while the antigen tube is being shaken. Care is required to obtain a mixture of considerable opacity, which is essential.

Out of the 5.0 cubic centimetres of antigen dilution take 4.0 cubic centimetres and place 0.5 cubic centimetre into each of the front row serum tubes. Each of the tubes in the test will now contain 1.0 cubic centimetre. In the back row there are two lots of 0.5 cubic centimetre serum dilution; in the serum tubes of the front row there are 0.5 cubic centimetre of serum dilution and 0.5 cubic centimetre of antigen dilution. In the additional tube of the front row there are two lots of 0.5 cubic centimetre of antigen dilution.

To each of the tubes now add 0.5 cubic centimetre of the complement dilution, 1 in 10. Place the tubes in the refrigerator for thirty minutes, then in the water bath at 37° C. for thirty minutes. During this period of waiting, the titration of the amboceptor can be carried out, as already described. If in that test the dilution of, say, 1 in 800 is indicated, the required amount can be calculated as follows: For each tube in the main test one requires 0.5 cubic centimetre—that is, for the 17 tubes one requires 8.5 cubic centimetres.

Using the 1 in 100 dilution of amboceptor, calculate as follows: $\frac{100}{800} = \frac{1}{8}$. Take 1.0 cubic centimetre of the 1 in 100 dilution and add $8.0 - 1.0 = 7.0$ cubic centimetres of saline solution; this gives a dilution of 1 in 800. Place the amount required in a test tube. In another, place an equal amount of the cell dilution, which represents 0.5 cubic centimetre for each tube in the test.

Ten minutes before the thirty minutes in the water bath have elapsed, mix the amboceptor and cell dilutions and place in the bath in order to sensitize them. When the time is up, add 1.0 cubic centimetre of the mixture to each

of the tubes in the test and leave them in the bath, shaking the tubes occasionally.

The Results.—In about twenty minutes begin to inspect the tubes. First inspect the tubes in the back row. In all of these hæmolysis should have occurred, unless one or the other shows an anticomplementary reaction by an absence of hæmolysis. Then inspect the "negative" control serum; in both of these tubes hæmolysis should have occurred. Then inspect the "positive" control serum; if hæmolysis has occurred in the back row but not in the front row, one may consider that the time for the inspection of all the tubes has arrived.

In the report on the reaction the following criteria may be used. All specimens of the serum which show complete hæmolysis in the front row are reported as "negative", always provided that the "negative" control serum shows the same result. If there is some interference with hæmolysis in the back row, and complete hæmolysis has occurred in front, the appearance of the back row can be disregarded. All the specimens of serum which in the front row show an absence of hæmolysis are considered "positive".

In a "positive" specimen of serum, in which there is as much interference with hæmolysis in the back row as in front, the reading cannot be taken into account at all. However, if there is interference in the back row to a much less extent than in the front row, the "positive" reading stands good; but nothing definite can be stated in regard to the degree of positiveness.

When hæmolysis is complete in the back row, the degree of positiveness in the front row can be readily judged in several ways. If the tubes are well shaken it is quite possible to determine up to three or four degrees of opacity.

If the tubes are left in the refrigerator overnight, or long enough to allow the undissolved red cells to settle to the bottom, a fine distinction can be made by a comparison of the colours of the superimposed fluid. If this is water-clear, the highest possible degree of positiveness is indicated. By a comparison of the various shades of the red colouring of the fluid, precise distinctions can be made.

The Preparation of the Antigen.

Heart muscle is used—guinea-pig, calf or ox heart. Remove all fat, cut the muscle finely, rub it down in a mortar. Take not less than five grammes. To each gramme add 50 cubic centimetres of absolute alcohol in a bottle. Shake well for several minutes. Place in a water bath at 60° C. for one and a half hours. Shake occasionally. Filter. It is immediately ready for use.

Each amount prepared is titrated. The titre, the amount to be used for each test, remains constant, and is employed until the whole of the antigen has been used.

A convenient method of titration is as follows.

Arrange test tubes in three series—series I for "positive" serum, series II for "negative" serum, series III for antigen controls without serum.

Have four rows of tubes in each series for descending doses of the antigen. Add a fifth row to series I and II for serum controls (see Diagram I).

Of the prepared antigen, take six times the dose that can be considered higher than required; 0.2 cubic centimetre can be taken as such a dose. Take $6 \times 0.2 = 1.2$ cubic centimetres and place in tube 1 of series III. Add to it the amount of saline solution which will bring each dose up to 0.5 cubic centimetre. That is, add $6 \times 0.3 = 1.8$ cubic centimetres of saline solution. Add the saline solution to the antigen in tube I of series III. In order to obtain a very opaque solution (which is necessary), the saline solution has to be added to the antigen very slowly while the tube containing the antigen is shaken.

Tube 1 of series III now contains 3.0 cubic centimetres of antigen dilution, representing six doses of 0.5 cubic centimetre, each containing 0.2 cubic centimetre of the antigen. From this take 2.5 cubic centimetres, leaving 0.5 cubic centimetre in tube I of series III, and place 0.5 cubic centimetre in tube 1 of series II and series I. Place the remaining 1.5 cubic centimetres in tube 2 of series III.

Now place 1.5 cubic centimetres of saline solution into tubes 2, 3 and 4 of series III. The 3.0 cubic centimetres now in tube 2 of Series III represent six doses of antigen dilution, each containing 0.1 cubic centimetre of the antigen.

From tube 2 of series III take 2.5 cubic centimetres, leaving 0.5 cubic centimetre in tube 2 of series III, and place 0.5 cubic centimetre in tube 2 of series II and I. Place the remaining 1.5 cubic centimetres in tube 3 of series III.

Tube 3 of series III now contains 3.0 cubic centimetres, again representing six doses of 0.5 cubic centimetre, each containing 0.05 cubic centimetre of antigen.

Continue the same performance in the fourth row of tubes and discard the remaining 1.5 cubic centimetres.

Every tube contains antigen; the tubes of each row contain a similar amount—thus 0.2 cubic centimetre in the first row, 0.1 cubic centimetre in the second row, then 0.05 and 0.025 cubic centimetre.

Tubes.	Series.			Antigen.
	I	II	III	
1				0.2
2				0.1
3				0.05
4				0.025
5				

DIAGRAM I.

The Dilution and Distribution of the Serum.

As in the main test, each tube containing antigen receives 0.5 cubic centimetre of serum, dilution one in five; an additional tube without antigen receives double the quantity of serum—that is, one cubic centimetre of the one in five dilution. Thus for each specimen of serum six times the 0.5 cubic centimetre dilution is required. Add a fifth row of tubes to series I and series II.

Into each of the tubes in the fifth row place $6 \times 0.4 = 2.4$ cubic centimetres of saline solution. In tube 5 of series I place 0.6 cubic centimetre of the "positive" serum. In tube 5 of series II place 0.6 cubic centimetre of the "negative" serum. From these 3.0 cubic centimetres of serum dilution of each series, remove 2.0 cubic centimetres and place 0.5 cubic centimetre in tubes 4, 3, 2 and 1 of the respective series.

Now add 0.5 cubic centimetre of saline solution to each of the four tubes in series III. Every tube now contains 1.0 cubic centimetre of a dilution.

In series I and II the first four tubes contain serum and antigen; the fifth tube of each contains 1.0 cubic centimetre of serum dilution without antigen. In series III each tube contains antigen dilution and saline solution without serum.

To each tube now add 0.5 cubic centimetre of the 1 in 10 complement dilution.

The tubes are placed in the refrigerator, and the test proceeds as described for the main test. The test is then read and the results are noted.

The dose of antigen in that row which in series I gives a perfect "positive" and in series II a perfect "negative"

reading, together with complete hæmolysis in series III, is to be taken for the correct dose of the antigen in question. Before it is definitely adopted, it should be tried in some routine tests beside an established antigen.

Summary.

This method has the following advantages:

1. The procuring and the preparation of the reagents offer no difficulty.
2. The dose of the antigen is constant; so also is the dose of the complement and sheep cells.
3. The method upholds Wassermann's original dictum that the reaction depends on the degree of interference with the hæmolytic system. For each test a standard hæmolytic system is set up by standardization of the amount of amboceptor to be used in the main test.
4. The time factor is also in its favour. If the time required for separating the serum and for inactivating it is left out, the whole test, even for a dozen or two specimens of serum, can be completed in one and three-quarter hours; one-quarter of an hour is needed for the preparation of the main test, for half an hour the material is in the refrigerator, for half an hour it is in the water bath, and half an hour is needed to await the reading of the test. The hæmolytic system is tested while the main test is in the refrigerator. It can be set up in less than ten minutes; it is read off in ten minutes.
5. Another point in favour of the method is that any level-headed laboratory technician can be taught the test in a day or two.
6. The controls and the whole test are easy of supervision, so that full responsibility can be taken by the person whose duty it is to guarantee the reports sent out.

Reports of Cases.

INTESTINAL OBSTRUCTION AT THE SEVENTH MONTH OF PREGNANCY, DUE TO LONG-STANDING AND EXTENSIVE PERITONEAL ADHESIONS OF OBSCURE ORIGIN.

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Clinical Record.

A.B., AGED twenty-five years, a *primigravida*, was at the end of her seventh month of pregnancy, when she began to have difficulty in defecation. Within a few days her abdomen became greatly distended, and she soon developed all the signs and symptoms of acute intestinal obstruction. She was sent to me with a diagnosis of acute hydramnios—a diagnosis which, owing to the enormous distension, was not unreasonable; but by the time I saw her it was obvious that the symptoms of obstruction overshadowed all others, and an immediate abdominal section appeared to be indicated. Dr. A. J. Gibson, who saw her with me, agreed with this decision.

On opening the abdomen through a mid-line incision one had to separate adherent coils of small bowel, both from one another and from the anterior surface of the uterus, before the latter could be satisfactorily exposed. A Cesarean section was decided upon at this stage, as it was quite impossible to explore the abdomen satisfactorily, so as to locate the cause of the obstruction, without first reducing the size of the uterus. After the uterus had been emptied it was found that the whole length of the small and large bowel was adherent; so extensive were the adhesions that there was no one portion of the bowel that was not adherent to an adjacent segment. The adhesions were not firm and dense, so that they were easily separated; but the whole bowel had to be turned out of the abdomen and each segment dealt with piecemeal. No kinking or obstruction of any particular loop could be discovered, and the whole of the small and large bowel appeared to be equally distended. At one section of the ileum two adjoining loops had become united and had opened into one another, just as if a successful lateral anastomosis had been per-

formed in early life. It was only after slight tearing of the peritoneum, in attempting to separate these two segments, that one realized the true nature of the abnormality in this region. After the whole length of the bowel had been freed, with the exception of this presumably natural lateral anastomosis, an appendicostomy was performed, so as to minimize the chances of any further obstruction. The bowel was then returned to the abdominal cavity. For the first few days there was some post-operative ileus, which was relieved by several injections of prostigmine. On the tenth day the patient developed a mild thrombosis of the veins of the left leg. Apart from these conditions her subsequent progress was uneventful.

Comment.

The cause of the adhesions was evidently a general peritonitis in early life, although the mother stated that her daughter had never suffered from any illness remotely resembling peritonitis. The appendix showed no signs of having been the cause. The patient was a twin and the other child had been stillborn. According to the mother, the surviving child was ill for several weeks, and it was considered at the time that she would not survive. After the first few weeks, however, she progressed normally. The patient said that throughout her life she had suffered from rather severe constipation, and at times had colicky pains and some abdominal distension; but she had led a particularly active life, as from childhood she had been an expert *equestrienne*, and horseback riding was her favourite pastime. My own explanation of the condition is that she had general peritonitis from umbilical sepsis in infancy, and that the lateral anastomosis discovered at operation occurred at this time and may have been the means of saving the infant's life. This, I admit, is rather a fanciful diagnosis, and I would welcome other suggestions as to a more likely explanation of the cause of the adhesions. It is remarkable that intestinal obstruction did not occur earlier in life or at an earlier stage of the pregnancy. Possibly the generalization of the adhesions prevented any one segment of the bowel from becoming kinked until the growing uterus made the onset of obstruction inevitable.

I have seen several cases of intestinal obstruction during pregnancy, some due to the small bowel's having become adherent to the uterus at the site of a previous perforation following curettage, and others due to abnormalities of rotation of the bowel; but I have never encountered a case resembling the one here recorded, nor can I find any record of such a condition.

Reviews.

ARTHRODESIS.

HAVING evolved a simple and ingenious method of performing ischio-femoral arthrodesis, H. A. Brittain presents in his monograph, "Architectural Principles in Arthrodesis" the application of the same principles to other joints.¹ After dealing briefly with the indications for arthrodesis and the causes of failure of fusion in many instances, he reviews some simple architectural principles and concludes this introductory portion of the book by advocating that a graft should be placed with its long axis in compression rather than in tension; that the breadth of the graft should be placed in the position of maximum stress; that a joint should be locked by two grafts crossing each other in the shape of the letter X; and that there should be adequate protection of the graft. The rest of the work is devoted to the practical application of these principles, and several ingenious methods of attempting to secure fusion in the different joints are described clearly and succinctly. The illustrations, along with their captions, could easily be described as an atlas of arthrodesis, while the reproductions of X-ray films offer adequate testimony that all the methods described have been performed with success. In an appendix to the chapter on arthrodesis of the hip the author adds a method of performing the operation in suitable cases by means of an ischio-femoral graft and a Smith-Petersen nail. The method should be quite suitable in cases of osteoarthritis of the hip joint.

The contents of this well-printed and beautifully illustrated monograph should prove of great interest to practising orthopaedic surgeons.

¹ "Architectural Principles in Arthrodesis", by H. A. Brittain, M.A., M.Ch., F.R.C.S., with a foreword by H. Platt, M.D., M.S., F.R.C.S., F.A.C.S. (Honorary); 1942. Edinburgh: E. and S. Livingstone. Crown 4to, pp. 144, with 136 illustrations and 8 colour plates. Price: 21s. net.

The Medical Journal of Australia

SATURDAY, JUNE 20, 1942.

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LOVE.

PROBABLY few words are so often misunderstood and therefore misused as "love"; and it can also be said with truth that the life of a man will show his understanding of the word. To one man love will mean a sexual adventure or series of adventures, another will know love in the intellectual sphere, and yet another will be unable to separate it from his relationship with society in general. Love is inseparable from the full life of man. In the opening chapter of his book "The Drama of Love and Death" Edward Carpenter writes that love and death move through this world of ours like things apart, under-running it truly and everywhere present, yet seeming to belong to some other mode of existence. They "move through the world, like closest friends indeed, never far separate, and together dominating it in a kind of triumphant superiority; and yet like bitterest enemies, dogging each other's footsteps, undoing each other's work, fighting for the bodies and souls of mankind". If a man has no love in his life, if death ousts love in the struggle, then is the soul of that man in darkness and he is of all men most to be pitied. Since there is a struggle which all must recognize, it at once becomes imperative to inquire what we mean by love or rather what love means to us, how we can ally ourselves with it or enter into it, and by its help lead a fuller and worthier life. But before these important general questions are considered, it will be useful to discuss love in the generally accepted sense as it influences the lives of men and women around us.

By love is generally meant the love of a man for a woman and of a woman for a man. The attraction of the one for the other has generally a sexual basis, and to the cold analysis of science the purpose of love is the continuation of life, the attraction is a force of Nature which aims at the propagation of the species. When the union of a man and a woman is based entirely on physical attraction it is really a tenuous affair; it lasts until the fancy of one or other party to the union is taken by the sexual possibilities of a third person or until endocrine function declines and desire begins to fail. Unions of this kind are the cause of more than a few of the

marital tragedies unfolded to the physician in his consulting room and to the lawyer in his chambers. They are melancholy affairs because they are destined at the start to be nothing but provisional transient episodes; the description erotic is best applied to them. People fall in love or imagine they fall in love for all sorts of reasons; perhaps in some cases they have the best of all reasons, which is that they have no reason at all. In love reason is probably the same as caution, and caution in love, according to Bertrand Russell,¹ is, of all forms of caution, probably the most fatal to true happiness. But it is not germane to the present discussion to deal with the many reasons why people fall in love. It must also suffice in regard to varying types of affection to declare that love may be divided by and large into two types—the one in which sexual love, bodily passion, eros (*ἔρως*), predominates, and that in which intellectual judgement and moral appreciation have pride of place. To the latter the Greeks applied the word *ἀγάπη* (*agapao*), meaning "to love dearly" as with brotherly love. The type of love in which sex is the driving force has already been mentioned and it has been described as doomed to death. It is almost invariably possessive and is subject to jealousy and all its painful sequelæ. The love in which intellectual judgement and moral appreciation predominate (*agapao*) is in essence the love that gives without illusion, without the need of reciprocity; to quote Amiel, it is "freed from this law of death". But "eros" and "agapao" are not mutually exclusive. If "eros" without "agapao" is destined to be a transient episode, "agapao" without "eros" is woefully incomplete. Love between two persons is most likely to be enduring when it is based on intellectual judgement and moral appreciation, when each gives freely of all that can be given and when sexual union becomes an expression of honour, of trust and of devotion, as well as of joy and delight. In such a union there is no apportioning, but a natural commingling, of "eros" and "agapao".

As of philosophical and philological interest, it may be recalled that the word "eros" was used by some of the early Christian fathers as expressing a spiritual and intellectual love and devotion. Origen, who was born in Alexandria in the year A.D. 186, is said to have been one of the greatest leaders known in Christendom. He is described as having "completely established the principle that Christianity is an intelligent religion by bringing to bear all the strength and vigour of Greek philosophical insight on the elucidation of Hebrew religious intuition and Christian spiritual history". Origen wrote that "John called God love and I do not think that anyone can be censured for calling him Eros". He took this bold step, we are told, because he wanted to interpret the human love poems of the "Song of Solomon" as an allegory of the mutual devotion between Christ and His church. With him "eros" expressed a passionate intensity and freedom from restraint which the more austere word "agape" less readily conveyed. For our present discussion it is to be noted that "eros" thus interpreted suggested "a vivid sense of love which surmounts all barriers and holds nothing back". In human relationships it need scarcely be said that even a love which surmounts all barriers and holds nothing back will not always be

¹ Bertrand Russell: "The Conquest of Happiness".

² G. L. Prestige: "Fathers and Heretics" (Bampton Lectures, 1940).

peaceful and free from misunderstanding. Such love would not be human. Goethe knew this when he said that love was "*Krone des Lebens, Glück ohne Ruh*" (the crown of life, happiness without peace). But here we must abandon this side of the subject and leave to each reader the devising of means to secure restfulness as well as happiness.

Thus far our discussion has been concerned with only one, and that probably the least important, aspect of an enormous subject. We have yet to define love. There have been many definitions. Schopenhauer said that love was in its essence a spiritual fire. Saint John said that God is love. Amiel wrote in his "journal" that love is a faith, it is eminently religious and may become a religion. Saint Paul wrote that love was the fulfilling of the law. Ouspensky, the Russian philosopher, declared that love is a cosmic phenomenon in which man is a mere accident. There is probably truth in all these definitions. When Saint Paul wrote to the Romans that "love is the fulfilling of the law", he made that statement just after he had written that "love worketh no ill to his neighbour", and he probably had in mind the "second" commandment (which was like unto the first): "Thou shalt love thy neighbour as thyself." Thus to say that love is the fulfilling of the law is a definition of love only in so far as it shows its working, though after all that may be as good a way of defining it as any other. Ouspensky writes that "love in relation to our life is a deity, sometimes terrible, sometimes benevolent, but never subservient to us, never consenting to serve our purposes". He continues: "Men strive to subordinate love to themselves, to warp it to the uses of their every day mode of life, and to their souls' uses; but it is impossible to subordinate love to anything, and it mercilessly revenges itself upon those little mortals who would subordinate God to themselves and make Him serve them. It confuses all their calculations, and forces them to do things which confound themselves, forcing them to serve *itself*, to do what *it* wants." Looked at in this way, love is something outside man which he may serve, and with which, being in its service, he may colour his whole life. If we accept the view that God is love, then our relation to love obviously depends on our conception of God and our relation to Him. And here too we may enter into love or allow love to enter into us and colour our whole lives. Finally, therefore, we come to the conclusion that, varying definitions notwithstanding, love is a spiritual force which may wield an enormous power in the lives of men. We can then understand what Saint Paul meant when he wrote to the Ephesians that if they were "rooted and grounded in love" they would be able to comprehend many things otherwise obscure to them. The subject of love is one which men should study, even if only singly or in isolated groups. They should use as a basis for this study the thirteenth chapter of Saint Paul's first epistle to the Corinthians (preferably in the "revised version"); this chapter, which is one of the noblest passages in the English language, sets forth in unforgettable words the attributes and the praises of love. Before very long, when the world is recovering from the convulsions of war, there will be urgent need for men who are "rooted and grounded in love". And this love will be the full and complete love, the love of humanity, the

love of a man for his fellow just because he is a man. It will be the love that worketh no ill to his neighbour, the love that rejoiceth not in unrighteousness, but rejoiceth in the truth. According to the number of men we have among us with this equipment so shall we be likely to lay the foundation of a just and stable future.

Current Comment.

WOUNDS OF THE GENITO-URINARY TRACT.

WOUNDS of the genito-urinary tract constitute only a small proportion of all the wounds of modern warfare, but nevertheless they are of greater importance than many of the more common injuries. It is many years now since Rutherford Morison made the statement that "rupture of the urethra is one of the most serious accidents, and unless your skill can prevent the development of a stricture you are presiding at the opening of a life-long tragedy", but this statement still holds true. Wounds of other portions of the genito-urinary system may be just as tragic as wounds of the urethra, and therefore, whenever possible, they should be treated not by the occasional surgeon, but instead by the genito-urinary specialist. Hugh H. Young¹ has recently published an extensive review of the subject of wounds of the genito-urinary system, in which he emphasizes the high mortality and morbidity rates of these injuries.

The incidence of wounds of the kidneys has been frequently under-estimated because severe wounds are often associated with other desperate injuries and are rapidly fatal. Of severe renal wounds complicated by injuries of other organs 57% were fatal, whereas similar renal wounds uncomplicated by other injuries had a mortality rate of 25%. The other organs which may be injured in addition to the kidney include all thoracic and abdominal viscera and many other more remote structures, such as the femur. Owing to the rapidity of spread of infection in the retroperitoneal tissues, concomitant injury of the large bowel is one of the most fatal complications of renal injuries and one in which early treatment is imperative. With renal injuries due to missiles there is considerable variation in the signs, symptoms and effects, depending on the amount of hæmorrhage and damage to other organs; but, as in all injuries, the first concern is for the control of hæmorrhage and for the treatment of shock. The treatment of shock is the same as that which is appropriate for all severe injuries; but special considerations exist in the treatment of renal hæmorrhage. If the hæmorrhage from the kidney is excessive, packing of the wound may be attempted; but if this is unsuccessful, a partial or total nephrectomy is indicated. If the hæmorrhage is less severe, expectant treatment may be quite successful. These two factors, shock and hæmorrhage, were the commonest causes of death on the field; but at the base hospital it was found that sepsis and secondary hæmorrhage were more common.

Wounds of the ureter are rare, but the bladder is more often involved in warfare. If the bladder is injured there is a desire to micturate; but this may be impossible or only a small amount of bloody urine may be passed. As with kidney wounds, the degree of shock varies considerably. The treatment of bladder wounds is also a matter of urgency, but it is necessary to differentiate between intraperitoneal and extraperitoneal rupture. Young concludes that if there is no intraperitoneal rupture or severe hæmorrhage associated with a wound of the bladder, then the best treatment consists of *débridement* and the insertion of a drain tube and perhaps an indwelling catheter. Urethral wounds were not common, but when present were generally but a part of grave injuries to adjacent structures, and treatment had to be varied with the other conditions found.

It is not possible to do more than direct attention to Young's review, in which details of treatment and

¹ P. D. Ouspensky: "Tertium Organum", 1928.

¹ Journal of Urology, February, 1942.

management are given, and to stress its importance to all physicians and surgeons who may be called upon to treat wounds of the genito-urinary tract; but it must be again emphasized that, whenever possible, these injuries should be treated by the genito-urinary surgeon.

CARCINOMA OF THE BREAST.

No finality has been reached on the treatment of carcinoma of the female breast, partly because of the bias which most surgeons and radiotherapists have for their own method of treatment and which tends to favour any conclusions they may draw from their results, and partly because of the difficulty in arranging properly controlled experiments from which an independent observer may draw unbiased conclusions. Most published results dealing with the treatment of carcinoma of the female breast (and of many other diseases) are confined to one special method. If any set of results obtained with one method of treatment is to be compared with another set obtained with a different method of treatment, it is usually necessary to assume that both sets of patients represent random samples of the sufferers from this disease. This assumption may of course be incorrect and may introduce grave errors in any deductions made. L. Clarence Cohn¹ has recently published an analysis of end results obtained after five years in a series of 192 cases of carcinoma of the female breast, in which special attention was paid to pre-operative irradiation. The difficulty of comparing results with another series treated by a different method arises, but apart from this there is a noteworthy lack of bias in Cohn's conclusions. As might have been expected, the results obtained five years after complete removal of the breast indicate that the end results have been largely determined by the grade of the tumour and the condition of the axillary lymph glands at the time of the operation. Cohn was unable to state whether the condition of the axillary lymph glands (as regards the presence of metastases) or the grade of the tumour were themselves modified by pre-operative irradiation. In the cases of restricted operations on the breast Cohn found that there was some evidence that irradiation therapy beneficially influenced the end results. Of the 68 patients in this author's series suffering from recurrent and inoperable carcinomata of the breast only one survived for five years. While there is no definite evidence in these results of the pre-operative value of irradiation of carcinoma of the female breast, this does not necessarily mean that irradiation is useless and that the surgeons convinced of its value are wrong. The results do, however, confirm the fact that irradiation is of very little permanent value in the treatment of recurrent and inoperable tumours.

ELECTRO-THERAPY AND DENERVATED MUSCLE.

ONE of the largest crops of serious injuries produced by war is that of damage to peripheral nerves. The question arises whether the combined experience of this war and the last, together with the lessons learned from many years of nerve injury in civilians, reveals electro-therapy as an important factor in assisting recovery. It is a hundred years since John Reid, of Edinburgh, first advocated repeated galvanic stimulation of denervated muscle for its beneficial effect. There are many authorities who continue to advocate his practice, but the question of its usefulness is still not settled, and experimentalists of high repute and surgeons of great experience continue to differ as to its value.

Ernest Gutmann and Ludwig Guttmann have studied the question by division of both peroneal nerves in the rabbit.² One limb was then treated daily for fifteen to twenty minutes by galvanic stimulation, while the other limb received none. The peroneal nerve was completely divided in two rabbits and the stumps were joined by suture. In four rabbits the peroneal nerve on both sides

was crushed with fine forceps, approximately eight centimetres from its entry into the *peroneus longus*. The current used was obtained from a dry battery of 120 volts, and was of a strength of four to six milliamperes. This produced a strong contraction, without apparently giving rise to pain. The anode and cathode were placed at opposite ends of the paralysed muscle so that the current was directed longitudinally. Observations were obtained of the circumferences of the two legs, of the time and quality of functional recovery, and of the direct excitability of the muscles to faradism. Periodical biopsies were made from each side, when the macroscopic and microscopic appearances of the muscle fibres and finally of the weights of the corresponding muscles were compared.

During the first two weeks after operation atrophy occurred uniformly on the two sides. Subsequent wasting was slower on the treated side of all animals. This difference became apparent within ten to fourteen days after the commencement of treatment. When reinnervation began, recovery was more rapid on the treated side. This was particularly noticeable in those cases in which the nerve had been cut and sutured. The circumference of the treated leg began to increase steadily from the twenty-eighth day after operation, while on the untreated side the first signs of increasing thickness of the limb were delayed as long as the seventieth day. Recovery of function began in both sides after about the same interval, that is, seventieth to seventy-seventh day, indicating that the rate of regeneration of the nerves is not increased by galvanic stimulation of the limb. With regard to response to faradism, both limbs showed an increasingly sluggish reaction after operation, but the diminution in direct excitability was undoubtedly less on the treated side. The most striking changes proved to be the histological appearances of biopsy specimens from identical corresponding sites in the musculature of the two limbs. Even with the naked eye it could be seen that the muscles on the treated side were undoubtedly larger than those which had not been stimulated. Some muscles were excised and weighed, and in all cases a considerable difference in favour of the treated side was evident. Transverse and longitudinal sections were prepared from the same points of corresponding muscles, mounted and stained together so that the histological picture should be strictly comparable. The muscle fibres on the treated side were of a greater diameter and showed more cross striation with little increase in connective tissue between individual fibres. These results leave little doubt that within the limits of this experiment electro-therapy in the form of galvanic stimulation several hundred times a day aided in the preservation of the nutrition of the denervated muscle of the rabbit. Atrophy began at once after destruction of the nerve, but never reached the degree or rapidity of that seen in the untreated muscle. The better quality of muscle action on the treated side after recovery of function was very obvious according to these observers, who further stated that the difference between the treated and untreated muscle could still be shown two months after the return of the reflexes.

Gutmann and Guttmann have proved in a very simple way that a century of progress and practice in the art of galvanic stimulation of the individual muscles of man has a sound laboratory sanction. The only difficulty here is that the results are those obtained from denervated rabbits' limbs rather than denervated human extremities. In the special hospitals of Great Britain to which such patients are admitted it may be possible to carry Gutmann and Guttmann's observations the necessary steps further, should some unlucky war victim be admitted with a double lesion of the sciatic or peroneal nerves.

CORRIGENDUM.

In an article on spontaneous hæmagglutination published in these columns on May 23, 1942, an unfortunate error was allowed to appear. By a typographical error the word "serum" was substituted for "cells". The serum of the laboratory assistant mentioned by Parish and Macfarlane agglutinated certain cells.

¹ Archives of Surgery, April, 1942.

² The Lancet, February 7, 1942.

Abstracts from Medical Literature.

PHYSIOLOGY.

Survival of Mammalian Sperm.

H. HOAGLAND AND G. PINCUS (*The Journal of General Physiology*, January, 1942) report the survival of 67% of human sperm after exposure to liquid nitrogen at a temperature of -195°C . The authors draw attention to the dependence of our estimates of time upon our body temperature, and suggest that a stay at -270°C , the temperature of liquid helium, with subsequent warming and recovery would be equivalent to projecting the organism forward a century into the future—a sort of Wellsian time machine idea. It has already been shown that a variety of small organisms can withstand the temperatures of the liquefied gases. The procedure in general involves rapid chilling and warming so as to vitrify the organisms and not permit their water to crystallize. This crystallization of water takes time, and colloidal solutions, with their large particles, are relatively slow to crystallize. The crystallization range for protoplasmic systems extends only some 30° to 40° below zero. Rapid passage through this range is essential if the organism is to survive the extremes of chilling. Organisms more than a millimetre in diameter cannot in general be cooled fast enough to prevent crystallization and death. The germ plasma of mammals seemed of special interest to the authors, since the storage of sperm would be of value in connexion with fertilization to produce offspring generations after the donor's death. Once the sperm is frozen the duration of the exposure to the low temperature seems without effect upon the subsequent percentage of survivals. The best results with human sperm were obtained by bubbling it through a capillary pipette and plunging it, trapped on a very fine screen, into the liquid nitrogen. The solidified foam is warmed by immersion in warmed Locke-Ringer solution. The revived sperm showed activity indistinguishable from normal controls. In the case of human sperm 67% of the living sperm survived vitrification, but in the case of rabbits only 0.5% and in the case of bull sperm only 0.1% of the sperm survived.

The Immediate Effect of Cigarette Smoking upon Basal Metabolic Rates of Men and Women.

V. R. GODDARD AND J. G. VOSS (*The Journal of Laboratory and Clinical Medicine*, March, 1942) have carried out tests on twenty subjects on a Benedict-Roth recording metabolism apparatus. The authors conclude that the apparent basal metabolic rate after smoking generally shows an appreciable deviation from a control rate determined prior to smoking, but that the generally accepted rise in basal metabolism some time after smoking is by no means a universal phenomenon. A rise in pulse rate, respiration rate and body temperature following smoking is generally observed. The sex of the subject is without effect in this respect. The authors mention the observations of Short and Johnson, who demonstrated the similar action of smoking and of small amounts of adrenaline on the pulse rate, the blood sugar content and the peripheral skin

temperature. A tentative explanation for the variable nature of the results is offered by the authors, who suggest that as the sympathetic system varies in responsiveness in different individuals, and as the adrenals are under its control, the response of these glands may occur after different time intervals in different subjects, causing a preliminary rise in basal metabolic rate, followed by a drop to subnormal values before returning to normal.

Thyroxin and Iodine-Treated Tadpoles.

F. N. MARZULLI (*The Journal of General Physiology*, March, 1942) describes the effects of some external factors upon the metamorphic pattern of thyroxin and iodine-treated tadpoles. It has been shown quantitatively that the degree of response of the hind limbs of tadpoles to the action of thyroxin is dependent upon the lengths of the limbs at the beginning of the treatment. Changes in hydrogen ion concentration affect the inducing power of thyroxin and iodine differently. With thyroxin it is the rate of penetration of the molecule which determines the amount of growth, but with iodine it is the chemical form in which the substance has entered the animal which is of prime importance. Change in hydrogen ion concentration of the environment does not affect the potency of thyroxin injected into tadpoles. When thyroxin is administered in the environmental solution, its effects as measured by increase in hind limb length are greater at higher than at lower hydrogen ion concentrations in the range tested. Since the potency of thyroxin is unaffected by change in hydrogen ion concentration when the thyroxin solution is injected, the above fact seems explicable only on the basis of differences in the rate of penetration of thyroxin into the animals at the different hydrogen ion concentrations. These differences in penetration of the thyroxin at different hydrogen ion concentrations may be the result of a differential effect of hydrogen ion concentration upon the rate of metabolism of the animal. The metabolic rate is significantly greater when the tadpoles are kept in solutions of higher hydrogen ion concentration than when they are kept in solutions of low hydrogen ion concentration. It is postulated that the rate of metabolism, since it controls the rate of intake of the environmental fluid, and therefore of dissolved thyroxin, also controls the amount of thyroxin-induced development. Change in hydrogen ion concentration of iodine solutions affects their potency when they are injected into tadpoles. A peak of effectiveness is reached at about the neutral point, with a lowered efficiency as the hydrogen ion concentration is either increased or decreased from this point. Change in hydrogen ion concentration of the environment affects the potency of iodine injected into tadpoles. The effect is similar to that noted above. The hydrogen ion concentration of the environment seems to affect the chemical nature of the iodine in solution in the environment. If this is so, it is possible that the differences in the metamorphic effects of iodine at different hydrogen ion concentrations are dependent upon the chemical form of iodine present. The effect of hydrogen ion concentration on normal development is similar to that on thyroxin-induced development; an effect on the rate of metabolism of the animal causes increased growth in more acid solutions.

Röntgenographic Observations Suggesting Difference between Total and Circulating Blood Volume.

R. B. RUTHERFORD, E. W. GODFREY AND J. Q. GRIFFITH, JUNIOR (*The American Journal of Physiology*, November, 1941), have administered pressor doses of "Pitressin" to white rats, have followed blood volume changes by hematocrit, hemoglobin and plasma protein determinations, and have compared these results with measurements of the circulating blood volume determined by the vital red method. Two procedures were followed. In the first the thorotrast was given first and fluoroscopic observations were begun. Then five pressor units of "Pitressin" were given intraperitoneally and the fluoroscopic observation was continued for thirty minutes, whereas in the second procedure the same dose of "Pitressin" was given first, followed in thirty minutes by the thorotrast. The results suggest that after the injection of a strong vasoconstricting agent, such as "Pitressin", the blood volume as measured by a dye method is greatly reduced. The authors suggest that a considerable amount of blood may be trapped in areas of the peripheral circulation, so that the actively circulating blood volume may be much less than total blood volume. The blood still circulating shows relatively slight changes in hematocrit red cell volume or in plasma protein concentration. The presence of blood vessels in the extremities containing blood, but without active circulation, is shown by the following. (i) Microscopy shows that the skin capillaries contain red cells, but there is no flow. (ii) Thorotrast introduced into the general circulation before the "Pitressin" is given remains in and outlines the vessels of the extremities. (iii) Blood cannot be secured by the cutting of a tail vein. (iv) Thorotrast introduced into the general circulation after the injection of "Pitressin" either does not enter into and outline the vessels of the extremities or does so tardily and to a less extent.

Inhibition of the Pyloric Sphincter Region by the Digestion Products of Fat.

J. P. QUIGLEY AND J. MESCHAN (*The American Journal of Physiology*, November, 1941) describe experiments devised to demonstrate the action of the digestion products of fat when introduced into the duodenum on the activity of the pyloric sphincter. The motor activity of the pyloric antrum, sphincter, duodenal bulb and distal portion of the duodenum were recorded by balloons, the pure fat digestion products being introduced just beyond the distal balloon. The inhibition of the pyloric sphincter region following the intraduodenal administration of soaps or fatty acids was qualitatively similar to that produced by natural fats. The action progressively diminished from the antrum to the distal part of the duodenum. The retardation of gastric evacuation produced by the entrance into the duodenum of fats or their digestion products apparently resulted from a decreased antral peristalsis and occurred in spite of a relaxed sphincter. In producing inhibition of the sphincter region, the fatty acids were one to two and a half times as effective as the natural fats. The soaps varied greatly from sodium butyrate, which was less effective than cream, to sodium oleate and sodium myristate, which were approximately

thirty times more effective. The evidence indicated that if natural fats were administered they initiated the inhibition and the digestion products continued the action.

Some Properties of Crystalline Guinea-Pig Haemoglobin.

S. GRANICK (*The Journal of General Physiology*, March, 1942) states that several lines of evidence lead to the conception of wet protein crystals as being made up of protein molecules with interstices between them, which are filled with loosely held solvent molecules. Sorensen estimated that 20% of egg albumen crystals is water; Katz has noted the ease with which water is lost from protein crystals under slightly diminished aqueous tension. Adair and Adair have studied the change in density of the crystals when suspended in solutions of different osmotic pressure, whilst Bernal and Crowfoot infer from X-ray data on wet crystals that the protein molecules are relatively dense globular bodies separated by relatively large spaces which contain water. From experiments made by the author, guinea-pig haemoglobin crystals are shown to be readily permeable to ferricyanide and hydrosulphite, indicating the presence of interstices between the protein molecules of the crystal. The assumptions of closest hexagonal packing and of spherical molecules of oxyhaemoglobin lead to a crystal lattice having interstices between the molecules which represent 25% by volume of the crystal. These spaces would be just large enough at their narrowest junctures to permit ferricyanide ions to diffuse through them. If these spaces were filled with water, then 20% by weight of the crystals would be water. The hemes are on the surface of the globin and are arranged facing the interstices between the molecules of the lattice. The binding of oxygen in oxyhaemoglobin is stronger in the crystal lattice than in solution.

BIOLOGICAL CHEMISTRY.

A Test for Nicotinic Acid Deficiency.

W. A. PERLZWEIG, H. P. SARETT AND L. H. MAROGLIS (*The Journal of the American Medical Association*, January 3, 1942) present one more of their studies in nicotinic acid metabolism and describe a test for the estimation of nicotinic acid deficiency in man. They had previously found that dogs given a diet poor in nicotinic acid largely retained a dose of nicotinic acid, and that after the dogs were well saturated by a high intake of nicotinic acid, most of the test dose of nicotinic acid was found in the urine as acid hydrolysable nicotinic acid derivatives and trigonelline. The test as applied to man was carried out as follows. The subjects were instructed to omit from their diets for three days coffee, all leguminous vegetables and nuts, all of which contain trigonelline; the diets were otherwise adequate. On the evening of the second day they voided urine just before dinner and discarded the specimen. All urine, including that voided on rising, was collected until the next morning and preserved with toluene. Each subject ingested with the dinner 500 milligrammes of nicotinamide and again collected all the urine voided until the next morning. The nicotinamide was administered intravenously in the presence of diseases which might

effect absorption from the gastrointestinal tract, including severe deficiencies. No disagreeable reactions occurred in any instance after the oral or intravenous administration of nicotinamide, and the results obtained after both methods of administration were found to agree well. The control and test specimens of urine were analysed for acid hydrolysable nicotinic acid derivatives and for trigonelline by a method described in 1940. The test was applied to 24 normal adults, to 53 young men, aged from sixteen to twenty-four years, undergoing "physical upbuilding" by means of diet and exercise, and to 56 men and seven women admitted to medical wards, who were acutely or chronically ill with a large variety of diseases. The majority of the hospital patients excreted in twelve to fourteen hours much less of the dose of nicotinamide than did the normal subjects. The group of undernourished youths excreted an intermediate amount after the same dose. The authors consider that the procedure described may serve as a test for nicotinic acid deficiency in man.

Plasma Proteins in Therapeutic Fever.

ISRAEL KOPF (*The Journal of Laboratory and Clinical Medicine*, May, 1942) has investigated the changes in plasma proteins of nine patients to whom malaria, artificial fever and typhoid fever vaccines were administered for treatment of syphilis of the central nervous system. He finds that fever produced by inoculation malaria brings about changes in the plasma proteins consisting of a rapid and marked drop in albumin content and fluctuations in the globulin and fibrinogen levels. When the malaria is terminated by quinine the values rapidly return to normal. Fever produced by typhoid vaccine and by the inductotherm causes only slight fluctuations in the plasma protein fractions. The author thinks that the more marked reduction in the amount of albumin during malaria may be due in part to the greater amount and more rapid recurrence of fever. The infectious process *per se* present in malaria is probably the most important factor interfering with the synthesis of albumin in the liver, even though dietary intake appears adequate. The increases in globulin are greater during malaria than during fever induced by typhoid vaccine or artificial means. The presence of an infective process and the destruction of red blood cells during malaria account for the greater increases in globulin content. Fibrinogen is increased during malaria and fever caused by typhoid vaccine. The progressive fall in the fibrinogen content which occasionally occurs during malaria indicates probable liver damage.

Serum Proteins and Cirrhosis of the Liver.

JOSEPH POST AND ARTHUR J. PATEK, JUNIOR (*Archives of Internal Medicine*, January, 1942), have investigated the role of serum proteins in cirrhosis of the liver, with special reference to prognosis and to the formation of ascites. Of 61 patients with cirrhosis of the liver who were admitted to hospital, 54 had an abnormal albumin-globulin ratio. As the level of albumin in the serum decreases, the prognosis as to duration of life becomes increasingly grave. Alterations in the level of serum globulin and of serum total protein have no such prognostic sig-

nificance. A direct correlation exists between the serum albumin level and the course of the disease; clinical improvement is associated with a rise towards normal of the serum albumin level, while no sustained rise occurs in instances of clinical failure. The serum albumin level is significantly lower in the presence of ascites than in its absence. Diuresis is associated with a rise in the serum albumin level. The mean serum albumin level at which diuresis occurs is 3.1 grammes per 100 cubic centimetres (standard deviation, ± 0.2 gramme). It appears that a fall in the serum albumin level is an essential factor in the formation of ascites.

JOSEPH POST AND ARTHUR J. PATEK, JUNIOR (*ibidem*), have continued their investigation of the serum proteins in cirrhosis of the liver by studying nitrogen balance in five cases. All the patients had cirrhosis of the liver, ascites and a reduced serum albumin content. Although they remained in a state of positive nitrogen balance while they were receiving a diet of high protein value, no correlated rise occurred in the serum albumin level. In this respect the patients differed from subjects suffering from simple protein starvation. The authors consider that patients with cirrhosis of the liver absorb and retain protein received in food, but that the mechanism for the synthesis of serum albumin is impaired.

The Effect of Androgenic and Oestrogenic Substances on the Serum Calcium Level in Skeletal Metastases from Cancer.

J. H. FARROW AND HELEN Q. WOODWARD (*The Journal of the American Medical Association*, January 31, 1942) have studied the effect on bone metastases from breast cancer of 10 to 12 injections of testosterone propionate in sesame oil given once to three times a week. The clinical material consisted of 33 patients, and about half of them obtained relief from pain; but there was no evidence of control of the disease. Three of the patients were subjected to more intensive therapy: unexpected hypercalcaemia and apparently increased growth of the metastases followed massive doses of testosterone and propionate and subsequent smaller doses of oestrone. Two patients with carcinoma of the breast, but without skeletal metastases, were investigated; it was found that injections of testosterone, oestrone or progesterone were not followed by significant changes in the serum calcium levels. A study of 130 cases of cancer of various organs that had metastasized to bone revealed many spontaneous disturbances in the serum calcium level. The changes occurred most frequently when the primary tumour was in the breast, but they were also observed when the primary tumour was in some other organ. The authors consider that the production of hypercalcaemia by testosterone and oestrone in patients suffering from cancer of the breast metastatic to bone is due to stimulation of the growth of the metastatic tumour by the hormones; an acceleration in the rate of bone destruction follows, accompanied by flooding of the circulation by the products of osteolysis. These considerations contraindicate the use of testosterone in the treatment of metastatic mammary cancer. Further study of this subject is required.

Medical Societies.

MELBOURNE PÆDIATRIC SOCIETY.

A MEETING of the Melbourne Pædiatric Society was held on Wednesday, May 13, 1942, at the Children's Hospital, Carlton, Dr. H. L. STOKES, the President, in the chair. The meeting took the form of a series of clinical demonstrations by members of the Society.

Pseudo-Hypertrophic Muscular Dystrophy.

Dr. L. P. WAIT showed a boy, aged nine years, who had first come under his care in the out-patient department of the hospital in October, 1940. Though the parents had noticed for some years that he was unsteady on his legs, the condition had become worse during the month preceding the first visit. He seemed to run clumsily, the calf muscles were tight and caused him to run on tip-toes, and he had difficulty in climbing stairs. Three years earlier the boy's elder brother had infantile paralysis, and Dr. Wait had had the opportunity to verify the diagnosis. At that time the present patient was quite well according to the parents, and there was no family history of muscular weakness.

At the original examination Dr. Wait had found the typical evidence of pseudo-hypertrophic muscular dystrophy, and even the electrical reactions of the muscles were consistent with that diagnosis. Since then the condition had progressively become worse. No glycine treatment had been used, but the boy had had vitamin B₁ in tablet form and by injections. The differential diagnosis from poliomyelitis had been a point of interest in 1940, as the brother had contracted poliomyelitis in 1937.

Dr. JEAN MACNAMARA was not convinced that the condition was not neglected poliomyelitis. She could see no reason why it was not possible in mild poliomyelitis for the muscle groups affected to be those customarily affected in dystrophy; irregular affection of the muscles was present. It was necessary to be quite certain before definite statements could be made about the unfavourable prognosis. One of her chief reasons for adopting that attitude was that she had had two experiences of poliomyelitis closely simulating muscular dystrophy.

Dr. H. J. SINN said that one female patient to whom Dr. Macnamara had referred had also interested him in his clinic, as no definite hypertrophy was present. He thought that when there was an element of doubt such patients should be treated along the lines followed in poliomyelitis.

Dr. H. BOYD GRAHAM mentioned the possibility that mild poliomyelitis might have been superimposed on previously existent muscular dystrophy. Dr. Wait's demonstration of the presence of the dystrophy could not be gainsaid, and it was well known that the onset was insidious and that, if one was on the lookout for it, it could be observed at a very early age and was probably congenital.

Dr. ROBERT SOUTHEY said that if the condition was due to poliomyelitis in 1937 the stage of final damage would have passed and some recovery rather than the progressive deterioration reported by Dr. Wait would have been expected in the past six months.

Dr. J. W. GRIEVE said that from the history, the progressive deterioration, the patient's pallor and the resistance in the pseudo-hypertrophic areas, he could see no reason for disputing the diagnosis. If the boy were to be immobilized, he would be much the worse for such treatment.

Dr. Wait, in reply, said that he thought it would be hard on the boy to be confined to his bed or in splints. Dr. Wait was positive that the condition was becoming progressively worse according to the usual manner in dystrophy. He also felt satisfied that the patient was weak on his legs before the illness of the brother. If the patient was to be placed in splints, not only would he be worse off, but the parents would be subjected to an unnecessary amount of expense, which they could ill afford.

Infantile Myxœdema.

Dr. W. W. McLAREN showed a male baby, aged six months, who had been in his care in the hospital for four weeks with so-called cretinism. Delivery had been difficult, and the patient's birth weight was eight pounds twelve ounces. The parents were healthy and had four other normal children. The story was that the baby had proved to be a "difficult feeder", that lactation had been inadequate, and that artificial feeding had been resorted to early. Sweetened powdered cow's milk dilutions and later sweetened diluted cow's milk had been used, but the food was hard to administer in adequate amounts. The baby was reasonably contented, but drowsy, and had made no attempt to sit up,

though during the time in hospital under treatment he had shown some interest in his surroundings. He had not made good weight progress, but had reached ten pounds five ounces. He was constipated, the skin was dry and peeling, and a paraumbilical hernia had required to be strapped from his birth. The child was pale, with a wrinkled forehead, an open mouth and a large tongue, which almost filled the buccal cavity and made it impossible to examine the throat. The body temperature was as a rule just above 97° F. The extremities were cold and the skin was dry, flabby and atonic.

While in the hospital the child was lethargic and constipated, though "Maltogen" had been added to the feedings to increase the amount of carbohydrate above the usual level. The blood cholesterol level was found to be raised to 288 milligrammes per hundred cubic centimetres. In the report after a radiological examination it was stated that there was as yet no appearance of the ossific nuclei of the epiphysis of the lower end of the femur and of the upper end of the tibia, but that the bony architecture of the shafts was not outside the limits of normality.

Dr. McLaren said that at first the amount of thyreoid administered was one-tenth of a grain of the dry gland twice a day and that the dose had been increased to one-third of a grain twice a day. It had been difficult to maintain the body temperature.

Dr. ROBERT SOUTHEY said that a point of interest in such cases was the dosage of thyreoid necessary from time to time to aid maximal growth. He had recently been interested in a report on the progress of two children to the age of fifteen or sixteen years.

Dr. J. W. GRIEVE recalled an instance in which the tongue was so large that tube feeding was necessary, until, with response to thyreoid therapy, the relative size of the tongue was reduced and the child could swallow normally.

Dr. A. B. McCUTCHEN observed that even with good physical response to treatment, the mental response was usually disappointing.

Dr. H. J. SINN reminded members of a previous contribution of his at a meeting of the society on the study of growth in cretinism under treatment. Even when treatment was instituted in the first few months of life, the patients might not do well.

Dr. McLaren, in reply, said that he did not think it was right to label all patients with deficient thyreoid development as "cretins". Apparently there were all degrees of thyreoid lack, from complete aplasia of the gland to minor degrees of shortage of secretion. Probably it would be better to describe the condition as congenital or infantile myxœdema and to reserve the term "cretinism" for the condition of children born of mothers who themselves displayed evidence of defective thyreoid secretion. Such a use of terminology would be of assistance in prognosis. It had been his experience that children with extensive myxœdema from birth made poor mental progress. He was certain that the mental progress was not nearly so great as the skeletal and muscular development under treatment. Natural feeding was said to delay the onset of signs and symptoms, especially when the mother's thyreoid metabolism was satisfactory. The child he had shown had been unable to feed at the breast on account of the size of the tongue. With reference to thyreoid dosage, Dr. McLaren said that it was his usual practice to start with a small amount and increase it gradually till he had the first evidence of slight over-dosage and was able to fix the desirable maintenance dose for that child. What had been written years ago was not particularly helpful, because the diagnosis appeared to be made with certainty at an earlier stage in recent years, and the full clinical picture as described by the older writers had not the chance to develop.

Thyreotoxicosis in Childhood.

Dr. J. W. GRIEVE gave a demonstration on thyreotoxicosis in childhood; it was illustrated by a coloured cinematograph film showing the features of the disorder in a boy, aged six years, who had died from the condition rather dramatically some hours after partial thyroidectomy. Dr. Grieve also showed a girl, aged thirteen years, who was in his care at the hospital and who might require the operative treatment at an early date.

He said that the boy had come into the hospital in February, 1942, acutely thyreotoxic after a long period of treatment with iodine. At the age of three years operation had been advised by the local doctor because of goitre and exophthalmos and other evidence of thyreotoxicosis; but for almost two years he had had Lugol's solution orally (three minims three times a day), with regression of the signs and symptoms. Eleven days before his admission to hospital he had developed a cold, with sputum, laryngitis, a rise in the pitch of the voice and difficulty in swallowing.

Thereafter he had lost a stone in weight and had had intractable vomiting of everything but water. Dr. Grieve went on to say that the iodine therapy was not resumed and that during the three months that had elapsed between the patient's admission to hospital and operation he had been rested carefully and had had sedative treatment until he could sleep peacefully through the night. The sleeping pulse rate had fallen, but not so much as they had wished. The decision to operate had been made after consultations with Dr. J. G. Whitaker and Dr. Norman Harry, and every care had been taken to select the time for the operation until the operative risk was considered to be small.

DR. HOWARD WILLIAMS said that the boy looked well before operation and that the only unsatisfactory feature was the persistently high sleeping pulse rate. The boy had taken the anaesthesia beautifully and the operation went smoothly and well and was carried out expeditiously. For eight hours all was well with the patient, and then the temperature rose rapidly, the pulse became thready and the boy died quite suddenly. The two problems presented were (a) the extent of the thyroidectomy, and (b) the selection of the optimal time for surgical intervention.

DR. W. W. McLAREN said that he also saw the boy several times while he was under observation, and he had formed the opinion that he would have died if operation had been refused. He had had the only possible chance to overcome his troubles, and the result was disappointing to all concerned.

Dr. Grieve then showed a girl, aged thirteen years, who had been admitted to hospital on April 21, 1942, with acute thyrotoxicosis. The mother was myxoedematous and was undergoing thyroid therapy; in other respects the family history was not important. Three weeks before the patient's admission to hospital the mother noticed that the girl's eyes were prominent, and that condition had increased. The patient had also complained of pain in the groins and legs, especially after exertion associated with tremor in the legs on standing. The neck had always looked "full", but people had recently commented on the increase in size. Sudden and rapid loss of weight had occurred, amounting to a loss of seven pounds in the previous seven days. Her appetite was voracious and she "bolted" her food. She disliked hot weather because she sweated so much. Though her school work was usually fairly good, during the past four weeks she had lost interest, had become forgetful, and could not bother to exert herself.

Dr. Grieve went on to say that exophthalmos of moderately severe degree was present, associated with lid-lag. The pupils were equal in size and reacted normally to light and accommodation. There was a soft apical systolic murmur. The palms were hot and moist, and a coarse tremor of the fingers was noticeable without any fine tremor. The thyroid gland was smooth and evenly enlarged, the right lobe being slightly greater than the left; the gland moved freely with deglutition.

With reference to treatment and progress, Dr. Grieve said that the child had had complete rest in bed, adequate carbohydrate and sedative treatment with phenobarbital. During the first week the sleeping pulse rate had varied between 80 and 90 per minute, the waking rate being 96 to 120. She was constipated, but was eating well. During the second week she was unhappy at being confined in bed and wanted to go home; there had been some increase in the sleeping pulse rate, which had varied between 90 and 94 per minute, and the waking rate was between 96 and 120. In the third week some improvement had occurred and the basal metabolic rate had fallen from +30% to +22%. She had lost eight ounces in weight in the three weeks.

Dr. Grieve thought that the acute onset, the firm, much enlarged gland, the high metabolic rate, and the failure of sedative treatment to bring about material improvement were indications that it might prove necessary to resort to surgical measures, in spite of the fact that it could often be avoided in the goitrous conditions usually encountered in childhood.

Correspondence.

"THE WALLACE LINE."

Sir: The name of Spencer does not need introduction to the medical fraternity in Australia. As a zoologist and as an artist, Sir Baldwin Spencer occupies the front rank.

Of no less importance was his work on the meaning of the Australian aboriginal. This work is being carried on with remarkable success by an artist and scientist, Mr. Wm.

Ricketts, at Mount Dandenong, Victoria. Mr. Ricketts carefully investigates the legends and totems of the aboriginal, and then interprets his researches in beautiful clay models, which are appropriately treated in a kiln and so preserved for all time.

Both Spencer and Ricketts, and possibly other workers too, have shown that the centre of Australian aboriginal life is, or was, about an inland salt sea, situated in the interior of Australia. They further show that the limit of "Australian influence", as it could be termed, is as far south as Tasmania and as far north as Timor. The ocean waters, too, between Australia and these parts are very shallow.

Mr. Hugh Bowling, of King Island, an early settler there, told me of big quantities of bones, apparently kangaroo and wallaby bones, that were to be found in the southern corner of that island. The bones were bagged for sale by the early settlers, but they proved to be of no value. It is believed that when the subsidence of land joining Australia and Tasmania occurred, large numbers of these animals perished.

Turning north, Hudson Fysh, writing in *Walkabout* ("Australia's Unknown Neighbour—Portuguese Timor", May 1, 1941) says: "Timor lies just south of the Wallace Line, which marks the division between the Indies and Australia in regard to flora and fauna. In fact, the island might be described as 'being on the line', as features are present which occur equally well defined both to its north and its south. For instance, Timor, like Australia, abounds with eucalyptus, and flocks of white cockatoos can be seen throughout the island. The native population is estimated as 700,000, of whom 500,000 are to be found in the more prolific Portuguese territory. In appearance and intelligence, these natives give the impression of being in a class midway between the Javanese and the Australian Aboriginal."

One wonders, therefore, what this inland-salt-sea part of the continent of Australia may mean to us, and whether the Australian aboriginal, like the early Briton, may not yet prove to be a person of political and domestic importance.

And further, if Australian influence is limited north by the Wallace Line, as it seems it is, then an aggressor, superstitious and fanatical as the Japanese, might easily "balk" when he comes to Timor, or the whereabouts of the Wallace Line.

Yours, etc.,

J. L. WHITWORTH.

Kalorama,
Victoria,
Undated.

Naval, Military and Air Force.

APPOINTMENTS.

The undermentioned appointments, changes *et cetera* have been promulgated in the *Commonwealth of Australia Gazette*, Number 157, of June 4, 1942.

PERMANENT NAVAL FORCES OF THE COMMONWEALTH (SEA-GOING FORCES).

Appointment.—Frank Lionel Roden-Smith is appointed Temporary Surgeon Lieutenant (D), dated 5th May, 1942.

Extension of Appointment.—The appointment of Surgeon Commander (Acting Surgeon Captain) Alexander Scott MacKenzie is extended for a further period of one year from 26th June, 1942.

CITIZEN NAVAL FORCES OF THE COMMONWEALTH. Royal Australian Naval Reserve.

Fixing Rates of Pay.—Surgeon Lieutenant Sidney Arnold Sewell to be paid the rates of pay and allowances prescribed in the Naval Financial Regulations for Surgeon Lieutenant-Commander (on promotion); whilst acting in that rank, dated 20th May, 1942.

Royal Australian Naval Volunteer Reserve.

Corrigendum.—With regard to Executive Minute Number 24—notice of which appeared on page 765 of *Commonwealth Gazette*, Number 94, of 26th March, 1942—that portion relating to the appointment of Archibald John Collins, D.S.O., as Honorary Surgeon Commander is amended in that the name should read as now shown.—(Ex. Min. No. 49.)

AUSTRALIAN MILITARY FORCES.

Australian Army Medical Corps.

The provisional appointments of Captains N270849 M. W. Ginsberg and N281652 B. R. Schloeffel are confirmed.

The following officers are transferred from Australian Army Medical Corps, Australian Imperial Force, with regimental seniority in accordance with Army seniority: Major NX34901 R. Jeremy and to be Captain (Temporary Major), 21st November, 1941; and Captains NX72054 V. H. Vernon and NX70929 W. F. L. Liggins, 18th April, 1942.

Captain (Temporary Major) Q48260 M. J. McKillop is brought on the authorized establishment of Majors, 29th December, 1941.

The following officers are transferred to the Reserve of Officers: Captains (provisionally) W. H. Neild and M. H. Elliot-Smith, 13th April, 1942; and G. Forsyth, 19th April, 1942.

Captain (provisionally) W. A. E. Robertson is transferred, 10th March, 1942, and to be Major (temporarily), 4th May, 1942.

Captain R. J. Hoy is appointed from the Retired List, 9th March, 1942.

The following officers are appointed from the Reserve of Officers: Majors C. Shellshear, 24th January, 1942; Honorary Major Q119947 E. D. Ahern and to be Major (provisionally), 22nd January, 1942; and Captains C. N. Matheson, M.C., and J. B. Gordon, 24th January, 1942.

The following officers are appointed from the Reserve of Officers and to be Captains (provisionally): Honorary Captains D. W. Shepherd, 16th October, 1940; C. A. Finley, 5th June, 1941; R. F. Lowe, 1st November, 1941; N. L. Hall, 23rd December, 1941; D. Fowles, 1st January, 1942; N278582 H. K. Uren, 20th January, 1942; T. F. W. Power and G. A. Bolton, 24th January, 1942; N278667 M. J. Mackerras and N278668 E. Scott-Young, 7th February, 1942; N278689 E. F. L. Laurie, 11th February, 1942; W. J. Rawlings, 12th March, 1942; V. C. Dyring, 17th March, 1942; E. W. Turner, 23rd March, 1942; and C. V. J. Bryan, 6th May, 1942.

To be Major (temporarily).—Captain (provisionally) Q119578 T. K. Wilson, 2nd May, 1942.

To be Captains (provisionally).—Robert Jackson Snodgrass, 5th May, 1942; Alexander Owen, 6th May, 1942; Arthur Clive Saunders, James Harold Willmott Leadley, Horace Layton Spearman and Gertrude Urquhart Grogan, 9th May, 1942.

To be Honorary Captains.—Edward Douglas Boer, 23rd April, 1942; Alexander William Chalmers, 1st May, 1942; and John William Perry, 6th May, 1942.

ROYAL AUSTRALIAN AIR FORCE.

Citizen Air Force: Medical Branch.

The following are appointed to commissions on probation with the rank of Flight Lieutenant, with effect from the dates indicated: Frederick George Gibson (4892), 6th April, 1942; Gordon Victor Stanton, M.B., B.S. (5166), 20th April, 1942.

Reserve: Medical Branch.

The following are appointed to commissions on probation with the rank of Flight Lieutenant, with effect from the dates indicated: Cyril Harcourt Chambers, M.B., B.S. (4904), 8th April, 1942; Kevin Johns, M.B., B.S. (5175), Neil Furphy Pescott, M.B., B.S. (5177), Howard Ernest Williams, M.B., B.S., M.D. (5176), 20th April, 1942; Francis Kelvin Bartlett, M.B., B.S. (5167), John Beaumont Haynes, M.P.S., F.B.O.A., M.B., B.S. (5168), Peter James Bird, M.B., B.S. (5169), Owen Wheatley Bowering, M.B., B.S. (5170), Francis Philip Champion de Crespigny, M.B., B.S. (5171), William Redmond Dalton, M.B. (5172), Collin Patrick Harrison, M.B., B.S. (5173), Wilton Whitburne Rall, M.B., B.S. (5174), 24th April, 1942.—(Ex. Min. No. 70—Approved 3rd June, 1942.)

CASUALTIES.

ACCORDING to the casualty list received on June 10, 1942, Major W. H. Kellett, A.A.M.C., Manly, New South Wales, is reported to have died of injuries.

According to the casualty list received on June 11, 1942, Captain K. J. J. Dorney, A.A.M.C., Elwood, Victoria, previously reported prisoner of war, is now reported escaped, returned to Middle East.

Nominations and Elections.

THE undermentioned has applied for election as a member of the New South Wales Branch of the British Medical Association:

Brooks, Edward James, M.B., Ch.M., 1920 (Univ. Sydney). State Hospital and Home, Lidcombe.

The undermentioned have been elected members of the New South Wales Branch of the British Medical Association:

Barr, Kenneth Archibald, M.B., B.S., 1941 (Univ. Sydney), NX77251, Captain K. A. Barr, 2/12 Field Ambulance, A.I.F., Australia.

Cumberland, Victor Henry, M.B., B.S., 1941 (Univ. Sydney), Royal Prince Alfred Hospital, Camperdown.

Macintosh, Neil William George, M.B., B.S., 1933 (Univ. Sydney), Imperial Service Club, Barrack Street, Sydney.

Sara, Charles Ashur, M.B., B.S., 1940 (Univ. Sydney), 87, Fletcher Street, Bondi.

Stuckey, Douglas Seavington, M.B., B.S., 1941 (Univ. Sydney), 57, Spit Road, Mosman.

The undermentioned has applied for election as a member of the Victorian Branch of the British Medical Association:

Williams, John Fisher, M.R.C.S. (England), 1939, L.R.C.P. (London), Ballarat Mental Hospital, Ballarat (P.O., Alfredton).

Obituary.

MAURICE EDMUND LYNCH.

WE regret to announce the death of Dr. Maurice Edmund Lynch, which occurred on June 7, 1942, at Parkville, Victoria.

WILLIAM RICHARD TREMBATH.

WE regret to announce the death of Dr. William Richard Trembath, which occurred on June 11, 1942, at Windsor, Victoria.

Medical Appointments.

Dr. Geoffrey Frederick Beck, Dr. Edward Rae Cordner, Dr. Horace Iles Holmes, Dr. Robert McGladdery and Dr. Robert Wallace have been appointed Public Vaccinators in the Department of Public Health, Victoria.

Dr. Walter Frederick Matthews has been appointed a Member of an Advisory Committee on Technical Courses at Orange, New South Wales, for a term of office of one year from February 1, 1942.

Dr. Arthur Parkinson has been appointed a Medical Officer for the Gormanston Municipality, Tasmania.

Dr. Horace Rowland Guest Barrett has been appointed a Medical Officer at Brisbane Mental Hospital, Queensland, as from October 6, 1941, in pursuance of the provisions of *The Public Service Acts, 1922 to 1924*.

Dr. John Bertram Gilchrist Gibson has been appointed a Medical Officer (Eye Diseases) in the Department of Health and Home Affairs, Brisbane, Queensland, as from October 1, 1941, in pursuance of the provisions of *The Public Service Acts, 1922 to 1924*.

Editorial Notices.

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